# COGNITIVE INFORMATION PROCESSING AMONG HIGH AND LOW READING ACHIEVERS.

*A MAJOR RESEARCH PROJECT SUBMITTED TO NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING (NCERT)*

*BY*

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This is to certify that the major research project entitled "**Cognitive Information Processing among High and Low Reading Achievers**" is prepared by me as per the financial support of **National Council of Educational Research and Training (N.C.E.R.T.)**

# ABSTRACT

*The major objectives of the study were the following : (1) to examine the differences in performance of high reading achievers and low reading achievers on cognitive problem solving measures (Simultaneous, Successive, and Planning), teacher ratings of classroom behaviour, and different classroom achievement measures ; (2) to assess the differences in performance of two information processing groups (Reflective versus Impulsive) on several cognitive problem solving measures ( i.e. Simultaneous, Successive and Planning), teacher ratings of classroom behaviour, and different classroom achievement measures; (3) to find out the grade differences (Grade – 3, Grade – 4 & Grade – 5) to assess developmental trend) on different cognitive problem solving information processing measures, teacher rating of classroom behaviour and classroom achievement measures ; (4) to find out the common underlying factors among different cognitive information processing measures by factor analysis.*

*Three hundred children ( N=300), hundred each from Grade – 3, Grade – 4 and Grade – 5 were taken as the subject. All these children were administered five reading tests individually ( namely : phonological oddity, symbol substitution, open passage reading comprehension, two oral reading paragraphs). Children were rank ordered on the basis of their performance for each test separately for different grades. Children of each grade who were above $75^{th}$ percentile and below $25^{th}$ percentile point were selected as high reading achievers and low reading achievers respectively. After identifying the high reading achievers and low reading achievers for each grade matching familiar figure test – 20 was administered individually to these children. After MFFT $_{20}$ administration was over each child's position on scores and latencies obtained. The present study employed a recent procedure known as impulsivity score criterion (I-Score) for identifying reflectives and impulsives. The variable known as " I – Score" was defined as the standard score for error minus standard score for latencies (I=Z error – Z latency). Accordingly the subjects with negative I score form the reflective group and subject with positive I score form the impulsive group. On the basis of reading achievement and I score, fifteen children for each grade were selected as high reading achiever reflective, high reading achiever impulsive, low reading achiever reflective, and low reading achiever impulsive. That is how sixty children in each grade were selected and for all the three grades the total number of subjects were one hundred eighty for the final study. These children were administered cognitive problem solving measures individually. Teacher ratings of classroom behaviour were taken by using self control rating scale. Classroom achievement scores were obtained form the school examination records. All the dependent measures were analysed following multivariate and univariate factorial analyses of variance designs 2 (high reading achievers vs. low reading*

*achievers ) X 2 (reflective Vs. impulsive processing ) X 3 (grade – three, four and five). Other statistics used were Pearson's correlation and factor analysis.*

*Results revealed that the main effect of reading achievement (high reading achievers vs. low reading achievers ) and R - I information processing (reflective – impulsive) had independent effect since no interaction effect could be obtained. The high reading achievers outperformed the low reading achievers significantly on MFFT $_{20}$, figure copying and digit span. On the RCPM score and MFFT$_{20}$ mean latency score no significant difference was obtained. On the teacher ratings of classroom behaviour the high and low reading achievers were not differentially rated by the teacher. On the classroom achievement high reading achievers out performed the low reading achievers. Although, reflective information processing compared to impulsive information processing has been found to be a superior strategy in simultaneous processing, the same superiority could not be established in successive processing and planning. Reflectives also established superiority on teacher ratings of classroom behaviour and classroom achievement measures. The data revealed a developmental trend which showed that as the children grow older and move to the high grades, they follow the reflective strategy. They have better performance in cognitive measures. The classroom achievement in terms of percentage of marks, except drawing showed to be decreasing form grade – 3 to grade – 5. Correlational and principal component analyses following varimax rotation revealed three functionally independent factors which were identified as basic reasoning process, memory process, and motivational process.*

*Several conclusions are drawn from the above results. The inferior performance showed by low reading achievers may be attributed to deficiency on memorization process. In academic sphere they face tremendous difficulty in adjusting to their classroom situations and suffer from severe emotional and behavioural problems. Probably they lack efficient screening system. Moreover, the inappropriate use of simultaneous processing in case of successive processing and successive processing instead of simultaneous processing there by exhibiting a deficiency in planning process. The inferior performance showed by impulsive children compared to their reflective counterparts on a wide variety of cognitive tasks were primarily due to lack of motivation, lack of task concern, and they tend to mobilize less effort and do not engage in active search behaviour in complex problem solving tasks which in fact demand such cognitive operation. Majority of processing variables showed developmental trend, which seem to undergo a qualitative change as a function of age and educational experience. The study implied that different tests and tasks, traditionally used to tap different cognitive processes need to be revealed and reanalysed further for meaningful discovery of new dimension in cognition. The study has the direct implications for remedial educational programmes for impulsive processing group of children (estimated about 30% of the primary grade population).*

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# INTRODUCTION

*Reading is perhaps the most valued and almost certainly the most highly practiced scholastic skill. The ability to read is generally regarded not only as the basis of education but also as an essential possession of citizens of civilised countries. The ability to read constitutes the milestone of education, communication and success in life. Although students with learning difficulties have difficulties in many areas of learning, 30 percent are poor readers having academic problems (Snowling, goulandris & Defty, 1996). It is therefore important that, the teachers of reading disabled students be well grounded with the concepts and methodologies of reading (Foorman, Francis, Fletcher & lynn, 1996). The non print media which is designed to relate information and create appropriate learning experience to some extent is a sign of declining the value of reading in contemporary life. However, there is a strong contrasting evidence that reading is assuming a greater role at present what it was few years back. Illiteracy has become a more debilitating handicap than ever. A few generations ago people managed to get along quite well in the business and social worlds without the ability to read but they can no longer do so. Lengthier periods of compulsory education, minimum competency test, the requirement of diplomas and degrees for jobs, more comprehensive school testing programs and taking licensing all make life for the nonreader uncomfortable and full of impassable barriers. Quoting from teachers' point of view it is aptly said that "Children must learn to read so that they can later read to learn". Indeed, since reading is the basic tool for all academic subjects, failure in school is frequently due to inadequate reading ability.*

*Many of the ills of our society have been related to reading difficulties. The ranks of the unemployed, school dropouts and juvenile delinquents tend to have very poor reading skills upon examination, the problems of our schools, of poverty and of the concerns of troubled parents as well as the plight of most learning disabled students are all associated with poor reading. The over all literacy problem that confronts our nation is serious. In Indian context, the Department of Education estimates that almost one third of the school population has significant learning problems, most of which are reading related (Pani, 1991).*

*Learning to read is the most important task that children face during the first year of schooling. Speaking is natural and develops naturally for most children, where reading has to be taught. Inspite of good instruction, however, many children fall to learn to read at the end of their first year in school. Many reasons are given to explain why they fail. Most commonly believed reasons are :*

1. *Children's lack of exposure to printed or written material and experience with reading material in their daily environment.*

2. *The other one that is commonly given is that the children have a delay in their development or have some kind of specific deficit in their intellectual skills. Such specific deficit has to do with the ability to transform spelling to speech without such ability, reading fails to be an automatic activity. Such children read laboriously with a great effort rather than reading fluently. Reading fluency appears to be a second nature at the end of the third year of formal instruction at school.*

## Components of reading

*Rayner and pollatsek (1989) defined reading as the ability to extract visual information from the page and comprehend the meaning of the text. Hence, the process of reading consists of two aspects.*

1. *Word decoding*

2. *Comprehension*

### Word decoding.

*A printed word has visual characteristics that are perceived and received by the eyes. Processing from this state, the word is either visually coded as a pattern or phonologically coded as speech sounds. The word takes either of the routes and goes to the next stage which is pronunciation of the word. Once it is pronounced it goes to*

*the final stage of oral reading. This is presented in the diagram (figure - 1) given below (Das et al, 1994).*

*However, the cognitive processes underlying decoding are simultaneous and successive processes, because simultaneous processing is prominent in visual calling. Where as successive processing plays a major role in phonological coding, pronounciation of a word is assembled by organising speech sounds, corresponding to the printed word. This is predominantly a successive process requiring the motor programme (articulation of the sounds) for oral reading. This is elaborated in the following figure No. 2 (Das et al, 1994).*

*However, researchers have also emphasised that reading develops through stages. The knowledge of which is very essential in order to understand how the children read and what kind of specific difficulties are faced by the poor readers whom we call dyslexic.*

## Reading Comprehension

*The purpose of reading of course is to gather meaning from the printed page. Since comprehension is the heart and goal of reading, every reading programme should provide for the development of reading comprehension abilities. For many reading disabled students, reading comprehension is the major deficiency. They need to be taught specific strategies that will help them, become active readers who understand the text.*

*Research on the nature of reading suggests that reading comprehension consists of a dynamic interaction among three elements, 1. The reader, 2. The text 3. The context of the reading situation (Olson, Wise, Conners & Rack,1990).*

1. ***The Reader** : Each reader comes to a reading selection with some knowledge and interest that affect what the reader is willing and able to read. For example, a remedial reader with much knowledge and a keen interest in fishing may be*

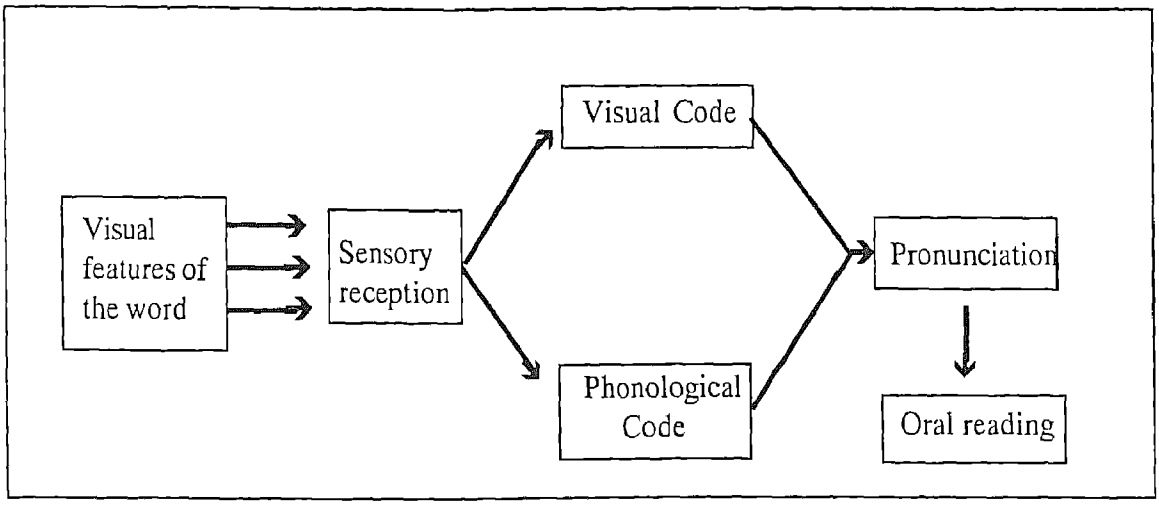
*able to read a fishing story on a sixth grade level. But that reader may be limited to a third grade level in history text.*

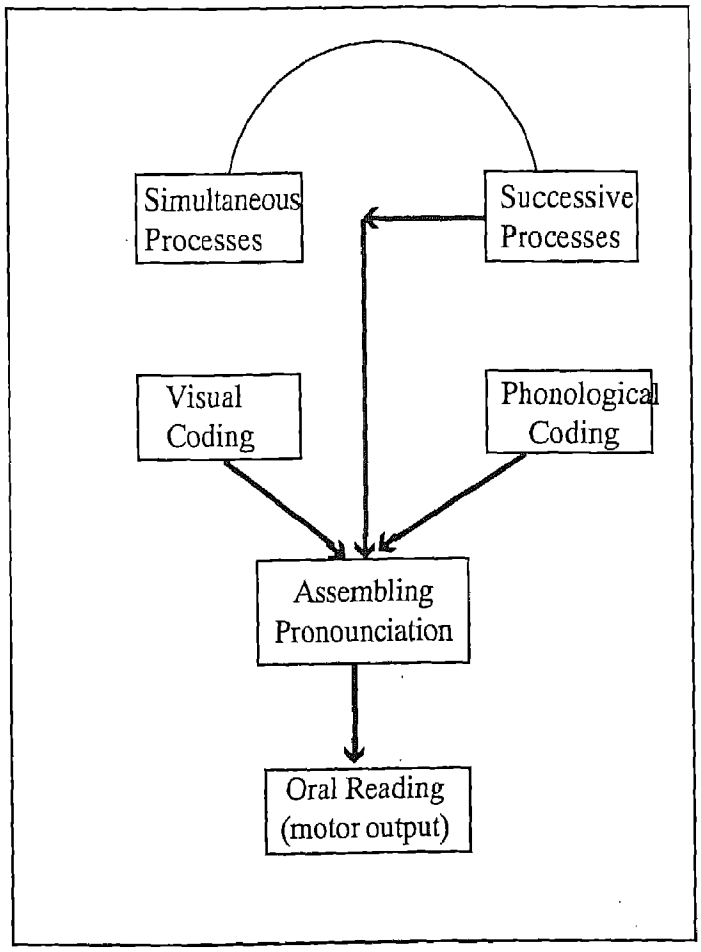
2. ***The Text*** *: This refers to the written language or the printed information presented to the reader. The clarity and organisation of the text will affect the readers ability to make sense of it.*

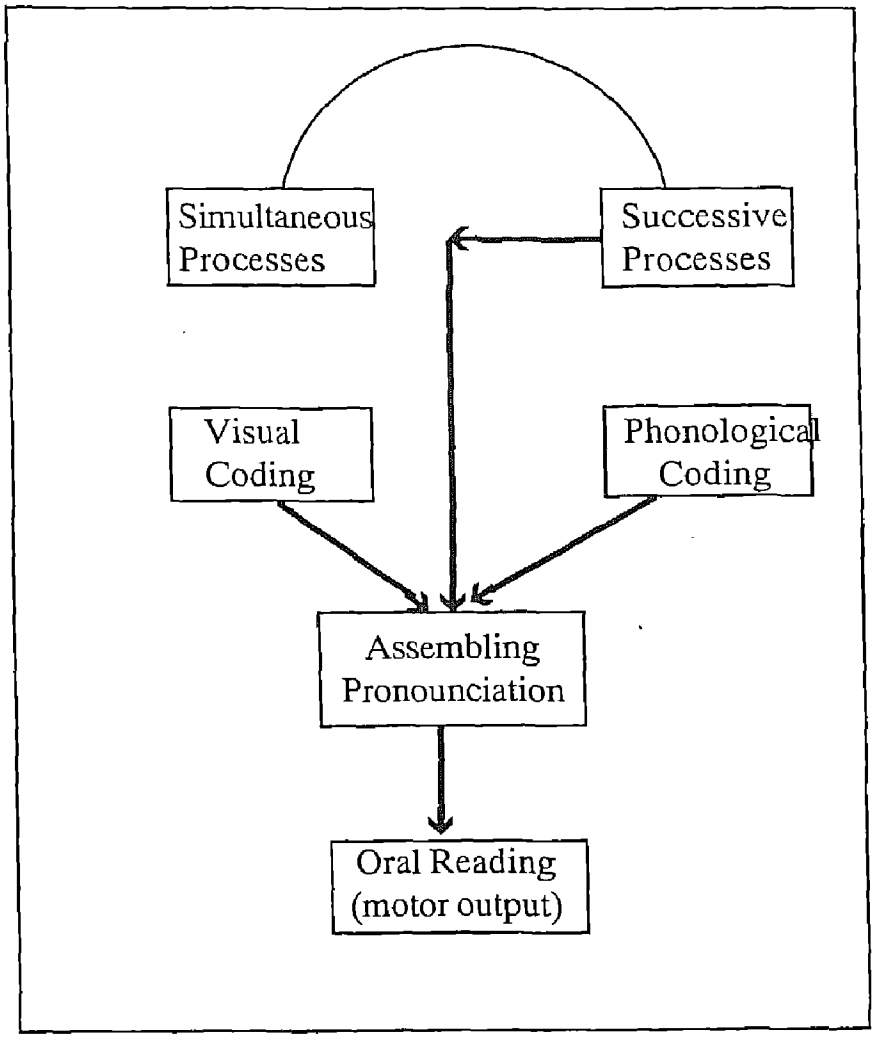
3. ***The Context*** *: The reading situation or environment also affects the reading process. For example, some children find tests frightening and have difficulty in reading them. These children might be able to read the same material in a less threatening situation. The purpose of reading is also part of the reading situation. A person will read one way when trying to understand detailed directions in a cook book and another reading a novel for enjoyment.*

*These three elements are present in every reading act. They interact to affect how the individual constructs meaning from the reading. More over, this interaction is dynamic and may change as the reader moves through the text. When the reader finds that information in the text conflicts with existing knowledge, the reading act becomes less comfortable. However, when the reader acquires more information about a subject through reading he or she is able to read the material more easily.*

*Reading comprehension involves cognitive and psycholinguistic behaviours. Readers must be able to bridge the gap between the information presented in the written text and the knowledge they possess to understand and remember what is read. As evidenced from research investigations background knowledge, interest and the nature of reading situation affect the level of material that students can read. Reading is not one task but a variety of complex tasks. Thus to understand why an individual student is having difficulty in school, we need to find out how the student learns and performs in different situations and with different types of reading material (Blachman, 1994; Adams, 1990; Bruck, 1990).*


Visual features of the word
Sensory reception
Visual Code
Phonological Code
Pronunciation
Oral reading


Simultaneous Processes
Successive Processes
Visual Coding
Phonological Coding
Assembling Pronounciation
Oral Reading (motor output)


Simultaneous Processes
Successive Processes
Visual Coding
Phonological Coding
Assembling Pronounciation
Oral Reading (motor output)

1. *Reading comprehension depends on what the reader brings to the written material: Reading comprehension depends on the readers experience, knowledge of language, recognition of syntactic structure and the redundancy of a printed passage ( Hulme & Snowling, 1992a; Bruck, 1990).*

2. ***Reading comprehension is a language process :*** *Any system of teaching reading must recognize that reading is a process for obtaining meaning through language, that is a psycholinguistic process. Consequently, Bruck (1990,1992) recommended that reading be taught as an extension of natural language learning. This can happen if teachers understand the language process underlying reading ( Manis, Custodio & Szeszulski, 1993. Snowling, Hulme, Smith & Thomas, 1994). During the reading process, the reader can not complete the thought until the final word or phrase and other clues for understanding both oral and written language are the redundancies in language. Redundancy means sending the same message in other forms. That is, information from one source supports information from another source, reinforcing and enhancing the indeed message and such cues therefore help readers to construct the meaning in a written text.*

3. ***Reading comprehension is a thinking process :*** *The relationship between reading and thinking has been documented for a long time. Defining reading as thinking, stauffer (1975) perceives reading as something a kin to problem solving. As in problem solving the reader must employ concepts, develop and test hypotheses and modify those concepts. In this way reading comprehension is a mode of enquiry and methods that employ technique should be used in the teaching of reading.*

4. ***Reading comprehension requires active interaction with the text :*** *To comprehend reading material, the reader must be an " active participant, interacting with the text material". Anderson et al (1985) suggest that to truly read, readers must actively combine their existing schema (conceptual structure*

*and knowledge) with the new information of the printed text. Many reading disabled students are passive readers, they don't know how to interact effectively with the text and merge the information with what they already know.*

## Stages of reading development

*Researchers have emphasized that reading develops through stages (snowling, Goulandris & Defty, 1996). While speaking is natural and spontaneous, reading has to be taught. Children may learn to read through instruction or by imitating family members. In a literate community the children get exposed to reading, long before they are really able to read. Preschoolers who can not read are frequently noticed to go through a series of developing stages which are as follows:*

### Magical stage.

*Just below the level of acquiring reading ability, children may consider any kind of mark made by a pen as equivalent to a word or a sentence. This is the magical stage, there being no connection between the scribbles that a child makes and the words the scribble is supported to represent.*

### Pictorial stage.

*As the child gets older and reaches the preschool level, it suddenly downs on him or her that words can be read like pictures. Children can recognize and describe pictures at an early age. They can also recognise simple words from the pattern of letters, but are still unable to read the word phonologically still they do not associate the spelling of a word with the pronunciation of the word, just before read it as a whole.*

### Alphabetic stage.

*The "whole word" reading is gradually transformed to reading the word by sound rather than by sight when children are assumed to develop the knowledge of connection between letters and sounds. This is the so-called "grapheme-phoneme"*

*correspondence. At this stage children learn the sounds of letters and realise that sounds can be combined to form words and the pronunciation of the word. In this stage children must pay attention to the order in which the alphabets occur in a particular word. When alphabets acquire sounds that are extremely specific to that alphabet, if they do not pay attention to the sequence of letters, they can never spell it correctly. The alphabetic stage starts with the child recognising the letters, associating the letters with particular sound, then combining the letters with their associated sound into words. Then alone the child is able to read.*

**Orthographic stage.**

*Orthography is concerned with how the word is spelled. The words 'bead' and 'dead' have similar spelling but quite different sounds because of the way the letters 'e' and 'a' are combined and pronounced in two words. Orthography, therefore relates closely to the ability for spelling. Sometimes though children can spell poorly but can read the word without any difficulty. These stages of reading are taken from a popular model suggested by Siegel et al, (1995). This story of progression from symbolic to orthographic stage is not universally accepted. Some research has shown that the beginning reader may use both the pictorial representation and the sound representation at the same time. It is also true that in languages such as Spanish, Italian, Sanskrit and Hindi, orthography may not play an important role because of the close correspondence between spelling and pronunciation. The word is read as it is spelled most of the time in phonetically regular languages.*

## Dyslexia

*The word was derived from Latin and Greek 'dys' as dysfunction which means difficult and 'legre' means read, similar to 'lexis' which means speech. Over all it means an impairment in the ability to read. This is an unusual type of severe reading disorder that has puzzle the educational and medical professionals for many years. People with this baffling disorder have extreme difficulty in recognizing letters and*

*words and interpreting what is seen visually or hard auditorily (Cruickshank, - 1986). Many of these individuals are intelligent in other ways.*

*For many years, it has been thought that dyslexia is linked to a neurological dysfunction, but neurological evidence to support this theory was lacking. Recent research in the neurosciences provides support for the hypothesis of a linkage between dyslexia and neurobiological abnormalities in brain function. Recent studies show that some dyslexic individuals have a different anatomical brain structure and there is a genetic basis for dyslexia (Galaburda & Kemper, 1979, 1983; Felton, Naylor & wood, 1990. Hulme & Snowling, 1992a).*

*Stanovich (1988) divided the children with reading difficulties in to two types: i. True dyslexic. ii. Garden variety dyslexic .*

i. *The dyslexic with specific cognitive deficits, can be easily found among children with high scores on traditional IQ tests, but have severe problems in acquiring reading (decoding) in elementary stage. The specific deficits in majority of dyslexic are in phonological coding, although visual-spatial problems can be found in a majority of poor readers (Brown & watson, 1991; Bruck, 1992. Fowler, 1991. Hulme & snowling 1992 a, 1992 b; Manis, castodio & szeszulski, 1993). ii. Garden variety poor readers show variety of mixed problems in intellectual and cognitive processing manifested in many areas such as putting things in sequence, seeing relationship among words, objects or pictures, attentional problems and inability to organise and plan ahead (Das, 1996. Das, Kar & Parilla, 1996; Share & stanovich, 1995).*

## Characteristics of reading disability

### Discrepancy Factor .

*The Discrepancy Factor, originally popularized by Bathemen (1964), is a key component in the 1997 identification criteria. Many authorities consider it to be the common denominator of learning disabilities. A discrepancy exists when a child's*

*estimated ability differs greatly form her academic performance. This factor, basic to the idea of underachievement, may be across one or all skill areas.*

**Academic Learning Difficulty .**

*Academic problems are the most widely accepted characteristic of learning disabled individuals. Academic problems mentioned in the 1977 identification criteria include basic reading skill, reading comprehension, written expression, mathematics calculation and mathematics reasoning. Reading problems are by far, the most common.*

**Language disorders.**

*Language problems, like reading and match difficulties, are interpreted in terms of the discrepancy component, Specifically, the 1977 regulations mention deficient skill in oral expression and listening comprehension. The works of Ortho (1937) de Hirsch (1952), Johnson and Myklebust (1967), Kirk (1966), and wiig and Semel (1980), reflect an increasing concentration on language problems. Marge (1972) estimates that 50% of learning disabled individuals have language deficits. Vogel (1975) notes that research indicates that many children who do not read well suffer from undertaking language problems. Because language skills and academic functioning are so closely related confusion exists concerning the diagnostic and instructional roles of language clinicians and learning disability specialists.*

**Perceptual disorder.**

*Perceptual problems (inability to recognize, discriminate, and interpret sensation) have traditionally received much attention by several learning disability authorities. Work in this area is highlighted by studies of visual and auditory perceptual disabilities. Some common terms in the area included visual reception, visual discrimination, visual memory, auditory discrimination, auditory memory, and intersensory integration. Although several leaders stress perceptual disorders, recently the emphasis on perceptual problems has diminished. The 1977 Federal*

*Register does not include perceptual disorder in the evaluation procedures of learning disabilities. However, C Cruickshank (1976) maintains that perception and neurological involvement are the key factors in defining learning disabilities. This position was evident in the national projects on the classification of exceptional children under the direction of Nicholas Hobbs. In this project a committee examined the classification of learning disabilities and finally offered the following definition : Specific Learning Disability : as defined here, refers, to those children of any age who demonstrate a substantial deficiency in a particular aspect of academic achievement because of perceptual or perceptual-motor handicaps, regardless of etiology or other contributing factors. The term perceptual as used here relates to those mental (neurological) processes through which the child acquires his basic alphabets of sounds and forms (Wepman, Cruickshank, Deutsch, Merency & Storther, 1975).*

**Motor disorders.**

*Myers and Hammill (1982) note five areas of motor disabilities: Hyperactivity, hypoactivity, poor fine and gross motor coordination, general awkwardness, and frequently delayed motor milestones. Students with motor problems may walk with a clumsy gait or have difficulty throwing or catching a ball, skipping or hopping. Others exhibit fine motor difficulties when cutting with scissors, buttoning, or zipping. Like perceptual disabilities, motor problems received substantial emphasis in research history but recently are being de-emphasized. For example, the 1977 Federal Register does not refer to them. Also the learning disabilities definition only mentions motor disabilities to the extent that basic physiological processes refer to them.*

**Social Emotional Problems.**

*Frustrated with their learning difficulties, many learning disabled students act disruptively and acquire negative feelings of self worth. Rappaport (1975) notes that their emotions develop differently from those of normal children. Rather than learning*

*and developing attitudes, about tasks they 'can do', learning disabled youngsters often learn what they 'can't do'. This lack of positive self-regard often results in poor self-concept and self-esteem.*

*Bryan and Bryan (1978) found that classmates often views a learning disabled child as someone they do not want as a friend. Bryan (1977) suggested that the social emotional problems of some learning disabled youngsters are due to social imperceptions. Specifically she reports that many learning disabled children lack adequate skills in detecting subtle affective cues. Although this position is speculative, it is similar to that expressed by Johnson and Myklebust (1967) and Lerner (1981). The following social emotional areas may be appropriate for organizing intervention with learning disabled children : hyperactivity distractibility, poor self-concept, social imperception, impulsivity, disruptive bebaviour, withdrawal, dependency and perseveration.*

**Memory problems .**

*During the 1970s, memory received much attention, however few conclusions can be drawn. Hallahan and Kauffman (1982) note that usually these students have problems in remembering auditory and visual stimuli. Teachers frequently report these students forget spelling, words, math facts, and directions.*

*Torgesen and Kali (1980) provided the following conclusions:*

1. *Learning disabled students fail to use strategies that non disabled students readily use. For example, in learning a list of words, the non disabled students will rehearse the names to herself or group the words in categories for studying. Generally, Reading disabled students do not spontaneously use these strategies.*
2. *Reading disabled students may have difficulty in remembering because of their poor language skills. Thus, verbal material may be particularly difficult to remember. (Hulme & snowling, 1992 b. Morton & Firth, 1995. Stanovich, 1994. Snowling & Hulme, 1994, Temple, 1990).*

## Attentional problems.

*To succeed in school, a student must recognise and maintain thought on relevant classroom tasks. He / She must be able to shift attention to new tasks. Students with attention problems cannot screen out extraneous stimuli and irrelevant stinuli which attract them. Additional behaviours include short attention span, distractibility, and hypersensitivity. Many researchers have documented the existence of attention problem (Hallahan & Kauffman, 1982).*

*Hyperactivity is often mentioned in conjuction with attention problems. Generally hyperactivity refers to an excess of non-purposeful motor activity (e.g. out of seat, finger and foot tapping, asking questions increasingly and often repeating the same question, inability to sit or stand still.) Recently, as a little league football coach, I had the opportunity to witness this phenomenon outside the classroom, william, one of our 10 years old players, was classified as learning disabled. At football practice he constantly picked fights, generally goofed off, talked back to coaches, and used "tacky" language. After a long practice in which william had been especially difficult to manage, the head coach asked the players to gather in front of him. William obeyed. In no uncertain terms the coach told them to listen to what he was about to say because he did not want to repeat his instructions. After he was assured everyone was listening, he proceeded to tell them that the next practice was on Monday at 5:30 and for them to wear their helmets and pads. Then he asked if there were any questions. William raised his hand. The coach responded, "Yes William?" William replied, "When's the next practice?" The coach, obviously upset with the question, responded, "William, What was the first thing I said?" William thought for a moment and replied, "Listen, "the coaches and players, including William, all enjoyed a good laugh.*

## Theories of Reading Disability

*Specific reading disability is conventionally defined as severe difficulty in learning to identify printed letters and words in children who have at least average intelligence and who are not impaired by general learning difficulties. (Gough & Tunmer, 1986; Stanovich, 1988; Vellutino, 1979, 1987). As an etiological concept, it carries with it the implicit assumption that the reading problems of such children are caused primarily by constitutional factors such as organic disorder or genetic limitations that adversely affect cognitive abilities that underlie reading ability. Commonly used definitions of specific reading disability typically employ a number of exclusionary criteria defining experientially limiting factors such as low general intelligence, sensory deficits, emotional disorder, motivational problems, frequent absences from school, or socio economic impoverishment to aid in distinguishing between children whose reading difficulties are caused primarily by inadequate experience and children whose reading difficulties are caused primarily by basic deficits in cognitive abilities that underlie reading ability. However, aside from the fact that they provide no definitive means for distinguishing between these two groups, the use of such exclusionary criteria as the sole vehicle for identifying reading disability encounters at least two other problems. The first is that this approach does not necessarily screen out children whose reading difficulties might be caused primarily by inadequate schooling or limited exposure to reading readiness activities. This point is well articulated in a penetrating article by clay (1987), who argued forcefully that the failure to control for the child's educational history is the major impediment to differential diagnosis of reading disability. Indeed, she suggested that virtually all studies that have sought to evaluate basic process deficits explanations of reading disability are confounded by this problem and aptly pointed out that the adverse effects of inadequate prereading experience, inadequate instruction, or both can often mask or even mimic the adverse effects of constitutionally based cognitive defects. This occurs partly as a function of knowledge gaps and ineffective learning strategies and partly as a function of encumbering social and emotional problems that often accrue in reading-impaired children.*

*Clay's (1987) concerns are given a good deal of credibility by intervention studies that have shown that most impaired readers can acquire at least grade level reading skills if they receive early and labour intensive intervention to correct their reading deficiencies (Clay, 1985; Iversen & Tunmer, 1993; Pinnell, 1989; Wasik & Slavin, 1993). Her concerns are also inherent in the second problem associated with the use of exclusionary criteria as the sole vehicle for distinguishing between constitutionally and experientially based caused of reading difficulties. The problem is that the constitutional experiential dichotomy may, itself, lack ecological validity, at least in terms of the common stereotype that impaired readers, selected on the basis of exclusionary criteria, suffer from organic deficits that adversely affect one or another of the cognitive abilities that underlie reading ability. This may or may not be true in any given case, and the question of whether or not it may be true in some instances can only be addressed through empirical research. However, this and like stereotypes fail to reflect the fact that any given level of reading achievement is a by product of complex interaction between one's endowment and the quality of one's literacy experience and instruction, so that the child who is endowed with an adequate mix of the cognitive abilities underlying reading ability is better equipped to profit from experience and instruction in learning to read than is the child who is endowed with a less than adequate mix of these abilities. Indeed, the optimally endowed child may be able to profit from less than optimal experience and instructions, whereas the inadequately endowed child may have difficulty profiting from even optimal experience and instruction.*

*Through this analysis, the constitutional-experiential dichotomy may be usefully reconceptualized insofaras reading ability and the cognitive abilities under lying reading ability may be conceived of as continuous variables, whereas constitutionally based reading impairment may be conceived of as achievement at the low end of the reading ability continuum in children having reading related cognitive abilities that are also at the low end of their (respective) continuua. Conversely experientially based reading impairment may be conceived of achievement at the low end of the reading ability continuum in children having reading related cognitive abilities toward the middle or even upper end of their respective continuua, but who,*

*nevertheless, have difficulty in learning to read because of inadequate experience and instruction. Accordingly, the goal of reading disability researchers would seem to be three fold; first to isolate cognitive abilities that are especially important for learning to read, along with deficiencies in these abilities that might distinguish between poor and normally developing readers; second, to isolate experiential and instructional variables that differentially affect achievement in reading; and third, to isolate the genetic and neurological underpinnings of the cognitive abilities underlying reading ability in the interest of distinguishing between genetic and neuropathological causes of deficits in these abilities.*

**Selective attention theory.**

*Over the past few decades, researchers operating within this framework have made progress in all three areas and, thus, in distinguishing probable from improbable causes of reading disability. To illustrate, specific reading disability has been attributed to dysfunction in selective attention (Douglas, 1972), associative learning (Brewer, 1967; Fildes, 1921; Gascon & Goodglass 1970), crossmodal transfer (Birch, 1962) serial order processing (Bakker, 1972), and rule learning (Morrison & Manis, 1982), but dysfunction in one or another of these rather basic and general learning abilities would seem to be ruled out as significant causes of the disorder in a child who has atleast average intelligence and who does not have general learning difficulties, given that all of these cognitive abilities are entitled in virtually all tests of intelligence and are most certainly entailed in all academic learning, Moreover, the empirical evidence for etiological theories implicating one or another of them is weak (Vellutino, 1979, 1987; Vellutino & Scanlon, 1982). Reading disability has also been attributed to dysfunction in visual processing, as well as to deficiencies in the phonological, semantic, and syntactic domains of languages. Although the evidence supporting phonological deficit explanations of reading disability is very strong and highly convergent, the evidence against most visual deficit explanations is equally strong and is also highly convergent. At the same time, the evidence for semantic and syntactic deficit explanations is mixed.*

**Phonological deficit theory.**

*In brief, the results of a large number of studies, when taken together, permit the inference that reading disability in many cases, is caused by phonological coding deficits that impair the acquisition of phonological skills such as phoneme segmentation, letter and word naming, letter-sound mapping, name retrieval, and verbal memory. This inference is supported by cross sectional studies with both children and adults in which poor readers were generally found to be less proficient than normal readers on measures evaluating these skills (Brady, Shankweiler, & Mann, 1983; shankweiler, Liberman, Mark, Fowler, & Fischer, 1979, Tunmer, 1989; Vellutino & Scanlon, 1982; 1987a, 1987b, Vellutino, Scanlon, & spearing, 1995), as well as by longitudinal studies demonstrating that they are reasonably good predictors of achievement in reading (Adams, 1990; Blachman, 1984; Bradley & Bryant, 1983; Liberman, Shankweiler, Fisher, & Carter, 1974; Lundberg, Olofsson, & Wall, 1980; Vellutino & Scanoln, 1987b, Wolf, 1984; Yopp, 1995. Foorman, Francis, Fletcher and Lynn, 1996; Stanovich and Siegel, 1994;, Adams, 1990; Goswami and Bryant, 1990; Vellutiono, 1991; Foorman, 1994,1995; Olson, Forsberg and Wise,1994; Siegel, Share and Geva, 1995). Also supportive are regression studies demonstrating that task evaluating phonological skills account for more variance on measures of word identification than do task evaluating other language based skills or those evaluating visual processing abilities (Vellutino, scanlon, Small & Tanzman, 1991; Vellutino, Scanlon & Tanzman, 1994). However, the most direct support for a casual relationship between phonological skill and reading ability comes from training studies demonstrating that direct instruction in phoneme segmentation and letter sound mapping can improve word identification and spelling ability (Ball & Blachman, 1991, Blachman, Ball, Black, & Tangel, 1994; Bradley & Bryant, 1983; Byrne and Fielding-Barnsley, 1990, 1991; Foorman, Francis, Novy & Liberman, 1991, Fox & Routh, 1980, Lundberg, Frost, & Petersen, 1988; Vellutino & Scanlon, 1987b; Williams,1980).*

**Semantic deficit theory.**

*Some support for a semantic deficit theory of reading disability is provided by studies in which impaired readers have been found to be less proficient than normal*

*readers on tests or vocabulary development and semantic concept development ( Bryan, Donahue, & Pearl, 1981; Duane, 1986; Fry. Johnson & Muehl 1970, Kavale,1982, Loban,1963). However, the results of most of these studies are compromised by the fact that the participants evaluated either came from impoverished background or were generally impaired academically and not just in learning to read. Moreover, in studies more recently conducted by vellutino and his associates (Vellutino & Scanlon, 1987a; Vellutino, Scanlon and Tanzman, 1988; Vellutino et al., 1995), strong and reliable reader group differences on semantic measures were observed only in contrasts of poor and normal readers in sixth and seventh grade, but not in contracts of poor and normal readers in second and third grade. This pattern of result is contrary to a semantic deficit theory of reading disability. It is more in keeping with Stanovich's (1986b) suggestion that semantic deficit that may be observed in poor readers of the type, typically studied in reading disability research - that is, otherwise normal children who are not generally impaired in learning - are among the many cognitive deficits that accrue as a consequence of reading disability (what Stanovich called 'Matthew effects') and are not a primary cause of the disorder.*

**Syntactic deficit theory.**

*As regards syntactic deficit theories of reading disability, the research has been less conclusive, poor readers have been found to be deficient, relating to normal readers, on tests evaluating (a) knowledge of inflectional morphemes (Brittain, 1970; Vellutino & Scanlon, 1987a; Vogel, 1974); (b) comprehension of complex syntax (Byrne, 1981; Goldman 1976; Vellutino & Scanlon,1987a; Vogel 1974); (c) the ability to detect or repair grammatically ill-formed sentences, sometimes called "syntactic awareness" (Flood & Menyuk, 1983; Fowler, 1988; Tunmer, Nesdale, & Wright, 1987; Vellutino & Scanlon, 1987a) ; and (d) the ability to use sentence contexts to facilitate and monitor word identification ( Tunmer & Hoover, 1993). However, the origin of such deficiencies is at issue. Thus, Mann, Shankweiler, & Smith (1984) and others Shankweiler, Crain, Brady & Macaruso, (1992), suggested that poor readers may be found to have difficulty on syntactic tasks such as comprehending complex sentences, judging grammatically, or making use of*

*sentences for word identification because such tasks make heavy demands on working memory and poor readers. Mann et al, have ascertained limited working memory capacity as a consequence of phonological coding deficits. Moreover, in a series of studies conducted by Mann et al, poor and normal readers who were distinguished on working memory and other phonological tasks were found to perform at comparable levels on syntactic tasks that did not tax working memory, for example, sentences that were less complex and contained fewer idea units.*

*These results provide tentative support for the view that syntactic deficits in many poor readers may be a consequence of deficiencies in phonological coding that abnormally limit working memory capacity. However, we should point out that syntactic deficit in some poor readers could also be a consequence of prolonged reading difficulties. In fact, Vellutino and Scanlon (1987 a) found no statistical significant differences between second grade poor and normal readers on measured of sentence comprehension after controlling for working memory differences in the two groups. Controlling for working memory did not, however, eliminate differences between sixth-grade reader groups on these measures, in accordance with the possibility that syntactic deficits may accrue as a consequence of prolonged reading difficulties, of course, these two possibilities are not mutually exclusive and the issue remains open.*

*Finally, reading disability has been variously attribute to dysfunction in visual memory, visual form perception, spatial orientation, and directional sequencing, in addition to inherent spatial confusion and visual tracking problems associated with oculomotor deficiencies (Getman, 1985; Herman, 1959; Orton, 1925; Pavlidis, 1981). However, there is no abundant evidence that, poor and normal readers tend not to differ on measures evaluating visuospatial abilities of the types just mentioned (Vellutino, 1979, 1987), Similarly, well controlled studies evaluating visual tracking of nonverbal stimuli obtain no differences between these two groups, contrary to the notion that oculomotor defects cause reading disability (Olson, Kliegl, & Davidson, 1983 Stanley, Smith & Howell, 1983).*

*As regards constitutionally based cause of reading disability, results have been seminal but suffeustive. Support for the possibility may be related to inadequate*

*endowment has come from genetic studies that have documented (a) that reading differention occur more often in near relatives than in the population at large (b) that they occur more often in twin than in siblings, and (c) that they have a much higher concordance rate in monozygotic twins than in dizygotic twins (Decker & Vandenberg, 1985; DeFries 1985; Olson, Wise, Conners, Rack & Fulker, 1989, Olson, Wise, conners, & Rack, 1990). Moreover, a recent study has tentatively located a gene for reading disability on Chromosome 6, although this finding has not yet been replicated (Cardon et al. 1994). Finally, genetic and twin studies have shown that measures of reading ability as well as measures of phonological skills such as phoneme segmentation, letter-sound mapping, and rapid naming have high degrees of heritability (Olson et al . 1989; Olson et al. 1990). These findings have provided the most compelling evidence for a direct link between genetic endowment and reading related cognitive abilities.*

**Neuroanatomical theory.**

*Neuroanatomical studies reported by Galaburda and Kemper (1979); Galaburda, (1983) have provided suggestive evidence that reading difficulties, in some cases, may be caused by neurodevelopmental anomalities. In postmortem analyses of the brains of adult men with a history of reading difficulties, these investigators found defects in the architecture of the language areas of the left hemisphere. They also found that the left hemisphere was not better developed than the right hemisphere, which is a typical. The possibility that left hemisphere anomalies may be casually related to reading disability is given added substance by electro physiological studies conducted by Duffy, Denckla, Bartels and Sandini (1980) and by Shucard, Cummins, Gay, Lairsmith and Welanko (1985), who found that left hemisphere brain wave responses of dyslexic and normal readers engaged in various cognitive tasks were quantitatively different (Dykman, Ackerman & Holcomb, 1985; Harter, Anllo-Vento, Wood & Schroeder, 1988).*

*Finally, a small number of studies using both computed tomographic and magnetic resonnace imaging procedures to compare the structural integrity of the brains of impaired and normal readers (Hynd & Semrud-Clikeman, 1989;*

*Filipek, 1995) have in serval instances, revealed neuroanatomical differences between these two groups. The nature and location of such difference vary from study to study but are most frequently evident in the plannum temporale, insulate cortex, and corpus callosum of the brains of the impaired readers. However results, to date, have been inconclusive.*

**Reflection – Impulsivity Information Processing**

*Reflection-Impulsivity (R-I) is an information processing dimension based on individual difference phenomenon which has shown important qualitative implications in cognitive, problem – solving and academic situations independent of general intelligence or I. Q. Both Kogan (1983) and Kagan & Kogan (1970) from their extensive review of literature on individual variation on cognitive processess conclude that this disposition towards either a refelective or impulsive information processing has yielded important implications in varieties of cognitive problem solving situations. This information – processing dimension has most direct relevance and practical implications for the educational process of young children because of the fact that it involves a crucial problem – solving step known as evaluation process. In this the a child willingly and deliberately makes a pause and reflects to consider the quality of his / her cognitive products or out come in-terms of the accuracy of higher hypothesis and solution. This is particularly evident in case of complex problem – solving situations, which involve high response uncertainty. Children, who proceed by slow deliberations, make fewer errors, while others who respond in a quick, hasty impulsive fashion, make many errors. The earlier group is known as reflective information processor and later group is known as impulsive information processors.*

**Assessment and Generality of R-I Information Processing**

*Although a number of instruments having used to assess the R-I dimension, the Matching Familiar Figure Test (MFFT) is now consistently used as the basic index. The MFFT was developed by Kagan, Rosman, Day, Albert and Phillips (1964) and*

*have been demonstrated to be a reliable means of evaluating a child's relative position on the R-I dimension. In the MFFT, the child is shown a standard stimulus picture of a common object (e.g. a maple leaf or a cow-boy) and asked to choose the one of six strikingly similar variants that exactly matches the standard and rest five differing from the standard in a minute and not easily identifiable detail. The mean response time to the first response and the total number of errors for all items are the major dependent variables. The combination of these two response variables speed and accuracy on MFFT is typically used as an index of R-I.*

*The R-I dimension has been found to generalise to a variety of cognitive as well as behavioural measures. Messer (1976) had reviewed the generality of R – I dimension on a variety of cognitive tasks such as WISC verbal and Picture Arrangement performance tests, processing test, and the conceptual style test. The result showed that reflection – impulsivity is a stable cognitive dimension manifested in all of these tasks. Blocks, Block, and Harrington (1974), and Block, Gjerde, and Block (1986) reported that MFFT accuracy has important personality concomitants and co-relates which justify the generality of R – I dimension. Glenwick, Barocas, and Burka (1976) reported that impulsivity has important consequences for class room adjustments and meaningful impact upon social relationships among children. Kendall and Wilcox (1979), Kendall (1985) found that MFFT has been significaantly co-related with the self-control, performance in maze test, measures of behavioural observations taken during the test administrations. Weithorn, Corinne, Kagan, Udward, Marcus, and Maxine (1984) viewed that impulsivity – reflectivity had a far stronger effect on cognitive task performance and academic achievement that did activity level training. Egeland, Bealke and Kendall (1989) reported that rating of social and emotional adjustments were correlated with MFFT accuracy. The R-I dimensions has also been shown to be related to discrimination learning (Hemry, 1973) Perceptual learning (Harcum & Harcum 1973) moral reasoning (Schleifer & Douglas, 1973), classroom adjustments (Loper & Hallahan, 1980), self – confidence*

*(Campbell & Douglas, 1972), selective attention (Weiner & Berzonsky, 1975), self control (Kendall & Finch , 1979), social cognition (Peter & Bernfeid 1983) inhabitation of motor movement (constantini, corsini, Devis, 1973), locus of conflict (Montogomery & finch, 1975) interview response style (Kagan et. al. 1970) school achievement (Messer, 1970) role taking skills (Brodzinsky, 1980), reading ability (Shapiro, 1974), and free play behaviour. In a study on relfection impulsivity (conceptual tempo) and cognitive Functioning Ancillotti (1985) found the impact of R-I on problem – solving activity and cognitive learning and conceptual tempo seems to mediate the subject's competence, leading to crucial performance differences in varied situations. Camron (1984) reported that reflectives tend to be most strategic than impulsives as they approach problem requiring detailed analysis. This is suggested by the eye movements of children responding to MFFT items of similar tasks (e.g. Ault, Crawford & Jeffary, 1972; & Zelniker & Jeffrey, Ault & Parsons, 1972). The cumulative results suggest that reflective tend to employ a systematic and efficient scanning strategy as they respond to matching – to – sample tasks (Zelniker & Jeffrey, 1976).*

*However, a few studies conducted in the personality and social behaviour domains failed to find any significant relationship with R-I dimension (e.g. Moore, Haskins, & McKinney, 1980 ; Sergent, Vonvelthoven & Virginia, 1979). Block, Gjerde, and Block (1986) reported about more misgivings of MFFT as a measure of reflective impulsivity questioning its validity in preadolescence. In an ongoing longitudinal study the result showed that MFFT Latency by itself, accounted for almost no incremental vaariance in personality evaluation after error had been partialed out. The contribution of MFFT error was applicable and unique which has significantly related in many ways to behaviour, even after its shared variance with latency had been partialed out. It is concluded that the results, consistent with those obtained for the same sample of children 7 years earlier and consistent also with the result of many other investigators, are incompatible with the original interpretation of*

*MFFT. The results are also incompatible with Kagan (1986), Messer (1976) conjecture that developmental changes occur in the meaning of MFFT performance . In the interpretation of MFFT, evidence is offered for a competence, rather than a conceptual tempo. In the study the priority of continuing to use the MFFT as an index of reflection – impulsivity is strongly questioned, and Palacois (1984) discussed the relationship between reflection – impulsivity and operational development reviewing the results of available research. The author suggests new methods of research and indicates the need for further evaluation of the construct reflection-impulsivity.*

**Implication of R-I Dimension**

*The practical importance and clear implication of the MFFT and relfection – impulsivity have centered on a series of research findings which have consistently demonstrated that children with impulsive conceptual information processing perform significantly worse than their reflective pears on a variety of cognitive, problem – solving tasks and also in academic situations (see review by Messor, 1976 ; Kogan, 1983 ; Messer and Schacht, 1983).*

*Although research findings with regard to the relationship of R-I to personality, social cognition, and social behaviour have produced inconclusive results. There is some suggestion in the literature that impulsive children seem to be low socially competent, less mature and suffer from behavioural problems compared to their reflective counterparts. Schleifer and Douglass (1973) reported that impulsive pre-school children show less mature moral reasoning and more related by their teachers as less attentive, less reflective, and more aggressive than reflective peers. Berzonsky's (1974) data revealed that 6 & 7 year old impulsive children showed immature animistic thinking. Glenlwick and Burka (1975) found poor role taking skills in forth grade impulsive boys. In a story completion task designed to elicit responses to the threat of frustration. Campbell and Douglas (1972) found that impulsive children choose pessimistic endings where as reflective choose optimistc endings. The passive attempt by impulsives to deal with the frustrating events was*

*attributed to the lack of greater self – confidence and involvement in intellecutal tasks (Messer, 1976) Peters and Bernfeld (1983) reported that impulsive 8 year old boys considered assertive and aggressive behaviour to be less appropriate, but yielding and authority are to be more appropriate than reflectives, in response to hypothetical social conflicts. Block et al. (1974) found that impulsive children were anxious, hypersensitive, vulnerable structure seeking where as their reflective peers were found to be more reasonable, considerate, less aggressive, more emphatic, interpersonally mature and better able to delay gratification. Messer and Brodzinsky (1979) reported that fifth grade impulsive children exercise less control over their fantasy, aggression, and thus demonstrate more overt aggression, as rated by teachers and peers. Glenwilk, Barocas, and Burka (1976) found that impulsive fourth graders were higher in acting out, moodiness and learning difficulties compared to their reflective counterparts. Rotenlers and Nachshon (1979) noted that adolescent delinquents were more impulsive on the MFFT performance. In a very carefully designed, classroom observational study on 10 years old sample. Loper and Hallahan (1980) found that impulsive showed more attention shifts and off-task behaviour than reflectives. On teacher ratings of attention and hyperactivity, impulsives were rated lower in attention and higher in hyepractivity (Ault, Crawford & Jeffrey, 1972). Kendall and Willcox (1979, 1980) demonstrated that impulsives score higher on self control rating scale (representing low self – control) completed by classroom teachers.*

*On the other hand, a few studies did not find significant differences between reflectives and impulsives on several behaviour and social dimensions (e.g. Bentler & McClain, 1976, Moore, Haskins, and Mc Kinney 1980) did not find significant relationship between R – I and a variety of classroom behaviours, including attention distraction and aggression. Sergent, Vanvelthoven and Virginia (1979) also failed to find any relationship between MFFT scores and teacher and observer rating of hyperactive behaviour. Similarly, a reflective and impulsive forth grader were not*

*distinguished on teacher of self-rating of behavioural impulsivity (Bjorklund & Butler, 1973). Wile examining the relationship of R – I to personality, social cognition and social behaviour, one frequently encounters the inconclusive and inconsistent results and a very few carefully designed the studies. This may partly be due to the more concentration of research interest in the cognitive, intellectual, and problem solving domains even though cognitive information processing falls theoretically some where between cognition and personality.*

*Considering the findings of the above research it is clearly and consistently demonstrated that impulsive tempo is a significant factor contributing to poor school performance, whether it is labeled as general learning disability, School failure, reading problem or inappropriate school coping. For many children certainly, the result of this impulsive response pattern is academic failure with its accompanying social and emotional difficulties.*

**Dynamics of R – I Cognitive Processing**

*Although the base of the explanatory models proposed to account for the difference between reflective and impulsive responding are a matter of continued debate, a substantial body of literature has been accumulated that provides sufficient insight on the deficient perceptual cognitive and motivational processes observed in the impulsive children (e.g. review by Messer, 1976, Wright & Vlietstra, 1977, Zelniker & Jeffrey, 1979). Although different interpretations such as constitutional factors, Criterion for accuracy, inability to inhibit response, anxiety over error, anxiety over competence, motivation, differences in attentional deployment and differences in preference of information processing have been suggested, the issue has been further complicated by the possibility that the above factors might be very well interrelated and overlapped with one another and that reflective and impulsive styles may be in the service of difference forces (Cheng, 1978). However, a consistent theme that appears across these several reviews can be categorized under three major psychological mechanisms, which demand further research work.*

## Strategy Preference

*Visual scanning studies of MFFT performances and several other studies (e.g. Drake 1970 ; Mc Kinney, 1973 ; Odom, Mc Intyre & Neale, 1971 ; Peters, 1979 ; Zelniker & Jeffrey 1976) have suggested that impulsive children employ a broad, global, gestalt like wholistic, and undifferentiated information processing strategy. On the other hand reflectives break down visual stimuli in to finer and minute parts on details and look for dimensions of differences among stimuli suggesting that they employ a more detailed, narrow, analytical and differentiated information – Processing strategy. As a result, Zelniker and Jeffrey (1976) theorised that each cognitive style group should perform better and optimally when task demands are compatible with their preferred processing strategy. Though the research findings the authors showed that reflective children were more accurate on details than global items and the reverse trend was achieved for the impulsives. But when between group comparisons were made the impulsive and reflectives performed equally well on global item but reflectives made fewer errors on the detail items compared to their impulsive counterparts. Moreover, it is hard to visualize problem situations and an adaptational strategy where all features of the stimulus settings are conveived as integral such that there are neither relevant features to attend nor irrelevant features to ignore (as mentioned in Zelniker and Jeffrey, 1979). The second problem is associated with the vagueness or lack of sufficient clarity in defining global versus detail analysis. In summary, although the strategy preference model provides a plausible explanatory model, research evidence favour the general superiority of reflective information processing style. To do well in most problem solving and academic situations, a detail information processing style seem to pay off well and it is therefore, Important to teach impulsive children to use a detail information processing style.*

## Motivational Explanation

*In this commentary to Zelniker and Jeffrey Series of Studies, Kagan (1976) observed that reflectives are generally more careful when the task is difficult compared to the postulation of basic differences in scanning strategies. This carefulness probably appears due to adequate motivational involvement. Although the issue of anxiety over making errors and total competence is still a matter of continued debate in R. I. Literature, the empirical studies (e.g Peter's study and reviews, 1979) have highlighted the fact that reflective children seem to be highly motivated to do well on intellectual and problem – solving tasks and are more anxious and concerned about avoiding failures. On the other hand, impulsives seem to lack initial motivation in intellectual and problem solving situations as evidenced from their tendency of lack of concern over committing errors. In a Study, Loper, Hallahan & Mckinney (1982) found that impulsives are equally capable of offering either a global or analytic response if their motivational level is properly manipulated by providing appropriate reinforcement in complex problem – solving situations. Along with the application of their model to explain the development of cognitive impulsivity the further empirical research may highlight the R.I. dimension.*

## Effortful – Effortless Model

*More recently attempts have been made to provide a working explanatory model of reflection impulsivity based on the integration of motivational and perceptual explanations (e.g. Wright & Vliestra, 1977 ; Zelniker & Zeffrey, 1979 ; Cheng, 1978). The models have been strongly influenced by the work of various information processing theorists, such as Broadbent (1977) and Jelesz (1975) who have put forward two levels of perceptual processing the first level involves the passive, fast, effortless and global processing and the second level involves active, slow, effortful, analytical and detailed processing. The model which is called the "effortful-effortless model" implies that reflective children can easily utilize the two levels of information processing depending on the task demands where as impulsives*

*are less likely to employ, and have difficulty advancing to, the second stage of processing which requires active control and more cognitive effort. As a result, impulsives respond globally, without much effort and hence inaccurately where detail analysis is called for. The theory does not predict that impulisives are incapable of effortful information processing, but the distinguishing variable is that the amount of active cognitive control being mobilized or typically exercised by impulsives are inadequate to meet the task demands. Studies have provided evidence to this conceptualization by demonstrating the fact that impulsives are more susceptible to the influence of perceptual saliency of stimuli (Hartley, 1976), show poor performance in tasks requiring selective attention (Weiner & Berzonsky, 1975), tend to performance worse on perceptual tasks requiring deliberate scrutiny and cognitive effort (Cheng, 1978). According to Wright and Valietstra (1977), impulsives engage in passive exploration which comprises rapid, automatic response guided by stimulus salience, where as reflectives tend to engage in active research behaviour which is deliberate, goal-directed and guided by relevance. Zelniker and Jeffrey (1979) proposed that impulsive's suboptimal mobilization of effort may result due to the low level of arousal, inappropriate causal attributional style (i.e. tendency to attribute failure internal ability and success to external factors such as luck), and faulty metacognition (understanding task difficulty due to low criterion of accuracy).*

*Douglas and Peters (1979) and Douglas (1983) have proposed a process model for explaining the development of hyperactivity which reflects many of the above discussed attentional, motivational, metacognitive, and effortful variables. The model assumes a constitutional predisposition involving primary defective processes of poor impulse control, impaired attention and effort poorly modulated arousal level, and inclination to seek immediate reinforcement. These primary defective process interfere with the metaprocesses by limiting development of higher order scheme, impairing metacognition and resulting in poor problem solving style by limiting search strategies. As a result of all these the child may experience repeated failure*

*R – I information processing. With an increase the child engages in search behaviour and better able to over come the effects differences in stimulus salience and selectivity attend to stimuli more in terms of this relevance. Hence, it is characterised by deliberate slowness, sequential continuity, and logical convergence. Typically it appears that exploration is upon characteristics of the information getting at the younger as facilitating impulsive information processing, where as, such behviour is the characteristics of older age that resembles typical reflective information processing (Wright & Viletstra, 1977).*

**Rationale of the Study**

*The above review of literature revealed that disabled readers have shown poor performance in almost all cognitive measures, intellectual tests and tests of achievement measure in comparison to their non-disabled counterparts. It is necessary and important to look in to why and how reading disabled children perform poorly on all these tests compared to non-disabled children. There is a need for comprehensive process oriented approach to the study of reading disability children's cognitive strategies (Das, Kirby & Jarman, 1975, 1979, Piaget 1976;). A measure theme appears from the critical review of literature that the typical tests, tools, and tasks used were basically oriented to measure "what" capacity the children have in terms of accomplishment in different tasks. Very few alternatives have been made in literature to unravel "How" the individual approaches a test or the strategies used to reach a solution. In other words the processing strategies and more specifically the individual difference in solving a complex problem had not been properly assessed. The traditional question was to measure the global intellectual ability in terms of the end products.*

*The need for a* ***"process"*** *rather than an* ***"ability"*** *approach to the study of learning disabilities can be justified in several ways. Abilities are typically believed to be fixed or resistant to change and these measurement is norm based. The level at which an individual is currently functioning in relation to a normative sample yields*

*information for screening and labeling . The ability measure is economical and has a certain value but it does not provide an understanding of the manner in which an individual has attained that level. Therefore, as estimate of an individual's ability obtained by administering standard and achievement tests has little or no implication for remediation. However one can not do away with ability measures. It is suggested that a good measure of intellectual abilities may serve three useful functions. First, it should provide a normative assessment of competence as is the case with existing psychometric tests of ability. Most ability tests do not go any further; then provide a score that can be interpreted in terms of a norm. A cognitive measure should not stop at this point. It should serve a second function i.e. the identification of process that are involved in doing psychometric tasks. A third and final function of cognitive measurement is to suggest the remediation of deficits that are detected by the tests. Measurement of competence and identification of underlying processes should be complemented by each other. Thus a process approach to the study of learning disabilities will facilitate the formulation of a remedial programme when it is needed.*

*In the present study a group of cognitive tests and measure have been carefully selected which are primarily meant to tap the various cognitive information – processing dimensions reflecting individual differences in terms of how the cognition is utilized or organised in reading. The High Reading Achievers and Low Reading Achievers in complex cognitive problem – solving situations. These tasks and tools have been carefully designed and hence, sensitive to detect the individual differences and reading ability differences. The basic assumption underlying these measures have been to find out how the individuals organise and utilize their cognitive world to meet the challenges of the complex and multifaceted stimulus environment. The quality of cognitive functioning and problem – solving is dependent on the mode and manner of information processing as to how different persons perceive, remember, and solve a problem in their unique ways rather than abilities. Outstanding performance and specific strategic skills occurs independent of general intelligence. As a result, in*

*recent years there has been considerable shift from the study of abilities to inquiry in to different functionally independent dimensions of processes such as encoding and decoding, memory and retrieval process, planning and evaluation processes etc. (Das et. al., 1979; Kagan, 1987). The child is an active organiser of his / her cognitive functions. He / she chooses (selective attention) what problem he / she will work on, decides how much effort to direct for the problem solution, selects the appropriate strategies (plan – fullness) to be applied, avoids, distractions and interruptions that hampers his / her efforts and evaluated the quality of his / her solutions. In the information processing approach the researcher is concerned with the differential demands which the different cognitive tasks place on the child's attentional, perceptual, memory, planning, metacognition , evaluation processes rather than on general intelligence. The general development across these domains is for the child to become more competent, sophisticated, and flexible information processor as he/she matures with increased age. Most of the studies reviewed in the preceding section were based on wrong assumptions and faulty orientations and have suffered from several methodological and conceptual shortcomings. Therefore, fresh studies are needed to be carried out involving information processing approaches to understand cognition following better scientific methodology, procedures, and with unbiased assumptions , new orientations and perspectives.*

*The review of literature in R – I information processing model suggested that the children who follow reflective information processing use a detail search strategies and deliberate scrutiny of the minute details of stimulus field. They also employ a detailed narrow analytical, and differentiated information processing strategy (Zelniker & Jeffrey, 1976, 1979, Rath et. al., 1987). The children were also found to be very active, slow and highly effortful depending on the task demand. Reflectives can deliberately move from the effortless state of processing to the effortful state of processing. On the other-hand children who follow impulsive information processing have been found to employ a broad, global, gestaltike, wholistic and*

*undifferentiated processing strategies. These children also have been found to be less motivated and employ a passive, fast, effortless and global processing as a result operate in an information getting and exploration stage, and less to likely to employ an organized search behabiour. When the task demands such exercise. The present study aimed at further examining the difference in performance of reflective and impulsive information processing groups of children on several cognitive problem-solving measures, achievement measures and teacher ratings on cognitive-behaviour measures in order to compare and find out empirical support for above hypothesized explanatory psychological mechanisms underlying R-I processing dimension. The tests and tasks selected and included in the present study were designed to be very sensitive to reflect above hypothesized genuine differences due to reflective-impulsive information processing.*

*Since age has been found to be an important parameter in the development of R-I information processing, the present study also aims at evaluating the impact of age factor in the growth of R-I information processing which under go qualitative and quantitative change with increase in age. The different age groups have been taken following a cross sectional developmental design. Although, cross-sectional design has several methodological shortcomings, the data obtains from such a design would reveal some developmental trend. Also the impact of age behaviour and achievement would be evaluated in case of R-I groups of High Reading Achievers and Low Reading Achievers.*

*An examination of the review of literature relating to the nature and functions of various cognitive tests and tasks employed in different information processing and intelligence models reveal the fact that there are some common underlying, mediating, cognitive processes, which need to be identified. Many of these tests and tasks share common variances and such as it is logical to expect that many such tests/tasks would yield significant interrelationships among them. One of the hunches was that if these cognitive tests are administered on a large sample and data analysed by the help of*

*intercorrelation matrixes and subsequently subject to multivariate analysis such as factor analyses, a few meaningful and significant common factor structures would enable the future generation of researchers to carefully select those tests and tasks which would really measures the cognitive process which the experimenter intends to measure. Many of the superflwous tests or some of the irrelevant components of the tests may be ignored or eliminated and researcher's time and energy can be saved. The test/tasks which would share common variances can be combined and a more meaningful new test or a battery of tests can be developed for tapping functionally more relevant and more cognitive process dimensions for practical use.*

## Major Hypothesis

*It is difficult to formulate specific hypothesis for each group and each task under investigation. However basing on the review or related studies tentative directions in results may be mentioned.*

### Hypothesis-1

*Research on dyslexic children show that they are deficient in their ability such as: encoding or decoding, memory and retrieval process, planning and evaluation, metacognition etc. (Das et. al. 1979; Kagan 1987). The major reasons of such characteristics probably due to lack of attention, information integration on metalinguistic awareness, perpetual deficits, effective interaction with physical and psychological environment (Senf et. al. 1979; Levine, 1987; Fletcher, 1980; Fletcher, Staz & Scholes, 1981; Ross, 1986; Vellutino, 1987; Turgesen, 1986). Hence it is expect that performance of low Reading Achiever may be less in all the cognitive reading achievement and behavioural measures.*

### Hypothesis-2

*The review of literature in R-I information processing model suggested that, the children follow reflective information processing use a detail search strategies and deliberate scrunity of the minute details of the stimullus field. They also employ a*

*detail narrow analytical and differentiated information strategy (Zelniker & Jeffery, 1976; 1979; Rath et. al. 1979, Pani, 1991). These children were also found to be very active, slow, and highly effortful depending on the task demand. On the other – hand children may follow impulsive information processing have been found to employ a broad, global, gestaltlike wholistic and undifferentiated processing strategies. These children are less motivated and employ a passive, fast, effortless and global processing. Hence it is expected that the performance of impulsive processing children shall be less on all the reading, cognitive, achievement and behavioural measures.*

**Hypothesis – 3**

*Since age has been found as an important parameter in the development of reading and R – I information processing, Hallahan, Kaufman & Ball (1974) reported developmental increase in the ability, because of qualitative and quantitative change. Therefore it is presumed that the performance of the children will enhance on all the reading, cognitive, achievement and behavioural measures from garde to grade.*

**Major Objectives**

*The major objectives, research questions and certain research directions addressed in the present study are outlined below.*

(1) *The first major objectives of the study was to examine the differences in performance of High Reaching Achievers and Low Reading Achievers on cognitive problem solving information processing measures, (i.e., Reflective – Impulsive, Simultaneous, Successive and Planning), teacher ratings of classroom behaviour and different classroom achievement measures.*

(2) *The second principal objective of the present study was to examine the difference in performance of two information processing groups (Reflective versus Impulsive information processing) on several cognitive problem solving information processing measures (i.e., simultaneous, successive, and*

*planning), teacher ratings of classroom behaviour and different classroom achievement measures in order to find out and compare the empirical support for motivational – effort deficiency hypothesis underlying R – I dimension.*

(3) *The third major objective was to find out the grade difference (Grade – 3, Grade –4, Grade – 5) on different cognitive problem solving information processing measures, teacher ratings of classroom behaviour, and classroom achievement variable in order to asses the developmental trend using a cross – sectional design. It is hypothesized that the higher grade children would perform better in all the reading, cognitive processing, teacher rating, achievement tasks in comparison to the lower grade children.*

(4) *The fourth major objective was to find out the pattern of relationship among the various cognitive processing variables and extract the common underlying themes / factors (processes) from the several cognitive tests / tasks used in the present study.*

# CHAPTER - II
# METHOD

## Subjects

*The subjects were 300 boys, selected from Oriya medium primary schools of Kujang Block in Jagatsinghpur district of Orissa, from Grade – 3, Grade –4, & Grade – 5, 100 from each Grade. The children were mostly from Bramhin, Khandayat, Milkman, Oilman, Goldsmith & confectioner families. All the children basically have rural background. The demographic characteristics of the villages were similar. Seventy percent parents of these children were socio-economically backward by earning their livelihood from marginal farming, daily labour, and small business. The literacy rate of villaes was up to 60% in general. The villages were not much developed in comparison to their modern urbanised counterparts. The teaching learning condition prevailed in schools were primitive in nature. Mostly rote learning is the basic procedure followed in the school. The schools have three to four rooms where five classes were held. In one classroom there may be two classes were held simultaneously. The calss teachers of different grades in their respoective schools were participated in the behaviour measures of indivisual subject.*

*The primary school children were selected as the target population because reading difficulty has been recognised as one of the major factors in educational failure. Parents and teachers on the basis of reading ability predict the academic success of their children. In the present study Grade –3, Grade – 4 & Grade – 5 children were selected because of the fact that development of reading ability becomes very distinct during primary schooling years. Children with low ability in reading are recognised as "typical children" and need special intervention programme for educational upliftment. From the cognitive development point of view the primary children shows a dvelopmental trend in cognitive information processing. Researchers (Rath, Mohapatra & Mishra, 1987; Pani 1990, 1991) seriously questioned the validity of measureing the tapping of different cognitive processing dimension and particularly the reflective-impulsive processing dimension during the pre-school and early school years.*

## Assessment Measures

*A set of reading tests are used for the identification of high reading achievers and low reading achievers. The tests used were; (a) Phonological oddity (b) Symbol substitution (c) Open passage comprehension (d) Cloze paragraph comprehension (e) Oral reading (tasks)*

*Then three general classes of dependent measures were used to examine the differences in performance of high reading achievers and law reading achievers as well as the reflectives and impulsives. The first set of dependent measures represented cognitive problem solving tests which included ; (1) matching familiar figure test (MFFT – 20) : (a) MFFT – 20 errors, (b) MFFT – 20 mean latency (2) simultaneours information processing : (a) raven's coloured progressive matrics, (b) figure copying score, (c) figure copying mean latency (3) successive information processing (a) serial recall (b) digit span forward (c) digit span backward (4) Planning : visual search total score.*

*The second set of dependent measures was teacher's rating of classroom behviour which included: (1) Self-control Rating Scale ( SCRS : 33 items and SCRS : 7 items ) developed by Kendall and Wilcox ( 1979).*

*The final set of measures used were, academic achievement tasks in MIL (O), Arithmetic, General Science, Social Studies, and Drawing. The above mentioned tests their administration and scoring processes are described in the following section.*

### Reading Tests

*Pani (1987) in his study have shown that phonological oddity and symbol substituion contribute more to metalinguistic awareness than several other tasks like strip-a-letter, rhyme recongnition, word creation, sentence synonymy judgement etc. As language awareness determines substantially reading ability, those two tasks are selected as the sample tasks of reading abilities.*

**Phnological Oddity:**

*This task was designed to assess the level of language awareness of the child phonetically. Hence, the test administrator presents four words in each time and the child is to discriminate one word, which is different from the rest of the three words.*

*For example, the researcher asked the child Badi, Bali, Basi and Kacha in oriya. The child has to tell which one is different from the rest of the three. The correct answer is "Kacha". In this study ten pairs were presented and responses were recorded. Each correct response gets one, total score is 10.*

**Symbol Substitution :**

*Symbol substitution task required the subject to substitute one meaningful word from another usually within a mixed sentence frame. In the present study, eitht questions with ten substituting words were presented. In question number three and seven there were two substituting words each. The child is to recognize that a word can be substituted for another instead of being immanently to its referent. In the first question the child was asked in Oriya by showing a toy aeroplane, what is this? After the child name it as an aeroplane he is told that in this game its name was frog. Then the child was asked what is its new name now? (Correct answer is frog). Can the frog fly? (Correct answer is yes). How does the frog fly? (Correct answer is with wings). After giving this example in all the eitht questions the child is asked to replace certain word instead of another name words. For scoring each correct response gets one. So the total score is 10.*

**Open Passage Reading Comprehension :**

*Test of reading comprehension measures how well a student understands what he is reading. The questions presume to ascertain the degree of understanding, which based on the assumption that a direct relationship exists between reading a passage and answering questions about it.*

*The reading comprehension test in Oriya was developed by Mohanty and Sahoo (1985). The test developed and standardized on primary and middle school (grade 1 to 7 ) level Oriya readers provides open comprehension passages followed by comprehension questions. There are two passages for each grade level. Up to grade three each passage contains five questions, while from grade four to seven passages contain seven questions. The test passages are given progressively from the lower to the higher grades and reading grade is calculated on the basis of the responses of the comprehension question. For scoring each correct answer gets a score of one and maximum score was 86.*

**Close Paragraph Reading Comprehension :**

*A means of measuring pupil's comprehension skill has been gaining popularity is the close procedure. The close procedure is a technique in which words are systematically deleted from a passage and the reader is expected to replace the deleted word while reading. It is comprehension task that is easy to administer, construct and score. Although the close procedure seems to be a valid and reliable measure of comprehension there are certain limitations which should be noted. (I) Some close test may contain many deletions for which there are no contextual cues. It is difficult on the part of the comprehended to fill the gaps if the numbers of deletions are more.*

*In order to avoid the above limitations the deletions were made carefully, may not included the important aspects of a sentence like verbs, nouns, adjectives, adverbs etc. Which can provide some contextual clues to the subjects. Two stories from the language proficiency assessment booklet by Sahu, Pattnaik & Mishra (1978) written in Oriya language were taken for this purpose. Care was taken to avoid some of the criticism of close procedure proposed by previous researchers. Previous research of the close task revealed that $8^{th}$ deletion was popularly used by researchers for grade four children. So every $8^{th}$ word was deleted and if the $8^{th}$ word does have any contextual base, it was being omitted and the next word in the passage was being*

*deleted. For scoring, 1 will be given for absolute correct response (exactly deleted word) or semantically correct response or syntactically correct response and zero will be given for unacceptable response or complete failure. As there are 14 deleted words total score varies from zero to fourteen.*

**Oral Reading Task :**

*This task consists of two passages. These two reading passages were standardised by Mohanty, Sahoo (1985) for class four children in Oriya language. The length of the two passages used in the oral reading are 108 words in 12 sentences and 115 words in eleven sentences. Each child was instructed to read a given paragraph aloud and a tape recorer was used to record them. The reading errors which the children produced while reading the paragraphs were scored on the basis of number of words omitted, number of words incorrectly read, number of words added and completed failure to read.*

## Cogniteve Problem sovling Measures

**Matching Familiar Figure Test ($MFFT_{20}$) :**

*The original MFFT is a complex match-to-sample task developed by Kagan, rosman, Day, Albert, and Philips (1964) which consists of 2 practice and 12 tests items. A more reliable version of this test, MFFT which consists of 20 test items, has been developed by Cairns and Cammock (1978). The MFFT is suitable for use with children with age range up to 11 years and was used in the present study. Each item consists of a standard picture of a common object (e.g.a mappleleaf) and six comparison pictures, one of which is identical detail. The task of the child is to select the picture, which exactly matches the standard; a maximum of six errors per item is allowed. Latency of first response on each of the items and total number of errors were recorded on all twenty items. For individual child the mean to first response and total number of errors, for all 20 items were scored at the initial recording.*

**Raven's Coloured Progressive Matrices (RCPM) :**

*Coloured progressive matrices were developed by Raven (1983). The test has been widely used as a non-verbal test of reasoning ability. However, Das, Kirby and Jarman (1979) has used this test as a good measure of simultaneous processing for children aged 5 to 11 years. It consists of 36 matrices or designs each having a part which has been removed. The task of the subject is to choose the missing portion from six possible alternatives. The 36 matrices were grouped in to three series, each series comprised of 12 matrices of increasing difficulty. The earlier series require accuracy of discrimination, while the later series involve analyses, permutation and alternation of pattern and other logical relations. This test is administered without time limit and subjects were encouraged to attempt every problem with no penalty for guessing. The time between the administration of the test and first response is to be recorded. The total number of correct response is also recorded.*

**Figure Copying :**

*Figure copying tasks was adopted by iig and Ames (1950) as a means for determining developmental readings for the traditional school learning tasks of the primary grades. The task requires the child to copy 15 geometrical figures which are visible to the child at all time and the difficulty legal is increased gradually. Each drawing is scored as 0, 1, or 2 according to the degree of correctness of reproduction. Scoring criteria emphasize the maintenance of geometric relation and proportions rather than exact reproduction. The test was used as a good measure of simultaneous processing in children (Das, et al., 1979). The maximum score was 30 and the time taken by the child to complete each drawing was recorded, so that the mean of latency for figure copying was computed for each individual child.*

**Serial Recall :**

*The items of Serial Recall were presented individually by means of a taperecorder. The subjects task was to recall a series of words verbally keeping the*

*order of presentation intact. Twenty-four groups of four words which were either acoustically similar (eg. Bhai, Daahi, Nai, Mahi) or neutral (e.g. Patha, Gacha, Ota, Ata) were given in Oriya language. Each series of four words was scored for words in the correct serial position as 1,2,3,4 and thus the maximum score was 96. The rest for about one-minute was given in-between 12$^{th}$ and 13$^{th}$ series.*

**Digit Span Forward :**

*The test is similar to the WISC-R (Wechsler, 1979). The experimenter reads to the child series of digits of increasing length, beginning with three digits, to a maximum of nine digits. The child was required to recall a series of digits keeping the order of presentation intact. If the child was unable to recall correctly any series of digit, he was given a second series of identical length. The digits were read at the rate of one per second. The both trial of each item was administered if the child passed the trial one. Each item was scored 2, 1, or 0, as 2 if the child passed both trials, 1, if the child passed one trial, and 0, if the child failed in both the trials. The maximum score for digit span forward task was 14.*

**Digit span Backward :**

*The test is similar to WISC-R (Wechsler, 1979). The experimenter reads to the child a series of digits increasing length, beginning with two digits, to a maximum of eight digits. The child was required to recall a series of digits in reverse order, as it was presented to him. If the child was not successful in reverse order presentation of any series of digits he was given a second series of digits of identical length. The digits were read at the rate of one per second. The both trials of each item was administered, if the child passed the trial one. The subsequent items of increasing length were presented till a complete failure. Each item was Scored 2, 1, or 0 as 2, if the child passed both trials, 1, if the child passed one trial, and 0, if the child failed in both the trials. The maximum score for digit span backward task was 14.*

**Visual Search :**

*Ashman (1978) adopted this test as a measure of planning. Das and his colleagues (Das 1980; Das and Heemsbergen, 1983; Kirby & Lawson, 1983) have used the Visual Search Test (VST) as a test of planning and have established the construct validity of the test in a large number of studies.*

*The Visual Search Test in its present from consists of 8 (9" x 11 ½") cards. Each card has two sections separated by a dividing line in the middle. Each section has a field of letters, numbers or pictures with an instance of a target inserted in to a square at the centre of the field. For an given card, the density, the frequency of distribution and the nature of stimuli (picture, number, or letter) in the response field are the same for both sections although the target instances are different. For each section the subjects task is to find an instance of the target at the centre from among the background stimuli in the response field which contains a duplicate of the target. As each card is presented, the subject is instructed to scan the response field as quickly as possible and indicate his response by pointing to the duplicate of the target in the response field.*

*The visual search cards were designed to measure two kinds of search; automatic (auto) search and controlled search. Thus there are four cards to measure auto search and four cards to measure controlled search. These conditions are build in to the arrangement of the instance of the target and the response field stimuli on the basis of their belonging ness to the same or a different stimulus class. While in auto search condition, the target stimulus and the background response field stimuli belong to different stimulus class. In the controlled search condition, they belong to the same class of stimuli. In auto search, two classes of stimuli are used; pictures and numbers. For two cards, the target is a number with the response field containing pictures; for the other two cards, the target is a picture with the response field containing numbers. Thus in auto search, the subject is searching for a number among numbers. In controlled search, the stimuli used are letters and pictures. For cards, the target is a*

*letter with the background response field containing letters; for the other two cards, the target is a picture with the background response field containing pictures. Thus in controlled search the subject searching for a picture among pictures or for a letter among letters. The background stimuli for each of the auto and controlled conditions also vary in density i.e number of items (pictures, numbers or letters) in the response field. Each condition consists of 2 cards for low and 2 cards for high density.*

*Time taken by the subject to find out the target in the upper and lower field in each card constitutes his visual search score.*

## Teacher Ratings of Classroom Behaviour

### Self Control Rating Scale (SCRS) :

*The SCRS developed by Kendall and Wilcox(1979) was used as a measure of cognitive self- control in children. The scale consists of 33+7 items to be rated by the teacher on seven point scale. High total score indicates mamimum impulsivity and low total score indicates miximum self-control or reflective behaviour. The scale is designed to tap cognitive factors such as deliberation, problem-solving , planning and evaluation along with behavioural components of self-control phenomenon. As reported by kendall et al (1979) the SCRC shows high test-retest reliability (.84) and high internal consistency (.98) Also the SCRC was reported to be significantly correlated with MFFT( $\underline{r}$ =.25, P<.005 with errors $\underline{r}$ = -.22,P<.005 with latency). The teachers was asked to rate item on a 7 point scale by circling the approximate number. The questionnaire was completed by the class teachers of the respective grade.*

### Achievement Measures:

*The achievement scores were recorded from the school examination marksheet for each children. It shows a mark of competencies of the children in different examinations conducted by the school in each grade. The scores were in language subject (M.I.L Oriya ). In reasoning (Arithmetic). In general information storeage*

*(general Science and scoial studies), in the area of drawing. The average score on different examination was recorded out of Annual, first terminal and half early examination held in the current session.*

## Experimental Design

| Reading Achievers | High Reading Achievers | Low Reading Achievers |
|---|---|---|
| Information Processing | Reflective – Impulsive | Reflective – Impulsive |
| Grade | 3 4 5 | 3 4 5 |
| No. of Subjects | 15 15 15 | 15 15 15 |

*The study involved 2 x 2 x 3 factorial between groups experimental design. The first factor represents reading achievement having two levels (i.e. High Reading Achievers Versus Low Reading Achievers). The second factor represents information processing having two levels (i.e. Reflectives versus Impulsives). The thired factor is grade having three levels (i.e. Grade – 3, Grade – 4 and Grade – 5). Thus independent variables are reading achievement, information processing and grade.*

*The dependent measures are congnitive processing tasks such as (1) Matching Familiar Figure Test – 20 (MFFT –20) (2) Simultaneous processing : (a) Reven's Coloured Progressive Matrices, (b) Figure copying score, (c) Figure copying mean latency (3) Successive processing ; (a) Serial Recall, (b) Digit span forward, (c) Digit span Backward (4) Planning : Visual search total score. The second set of dependent measures was the teacher's rating of classroom behaviour measures (SCRS : 33 items, SCRS : 7 items). The third set of measures are some achievement tasks (a) Language (M.I>L> Oriya) (b) Arithmetic (c) General Science (d) Social Studies and (e) Drawing.*

## Procedure

*Three hundred boys (N=300) from grade three, four and five 100 from each grade were taken as the subject. To identify the high reading achievers and low*

*reading achievers for each grade, five reading tests were administered (namely, phonological oddity, symbol subsituation, cloze paragraph reading comprehension, open passage reading comprehension, and two oral reading paragraphs) individually to all the three hundred children. Children were rank ordered on the basis of their performance for each test separately for different grades. Children of each grade who were above 75$^{th}$ percentile point and below 25$^{th}$ percentile point were selected as High Reading Achievers and Low Reading Achievers respectively.*

*After identifying the high reading achievers and low reading achievers for each grade, MFFT – 20 test was administered individually to these children. After the MFFT – 20 administration was over each child's position on the scores and latencies obtained with MFFT – 20. The dual medium split procedure using error and latencies to form different groups (such as slow accurate / slow inaccurate / Fast Accurate / Fast inaccurate) have been criticised on several statistical and methodological grounds including loss of data and loss of substantial information (Salkind & Wright, 1977 ; Smith & Caplan, 1988; Rath et al. 1987). The present study employed a recent procedure known as impulsivity score critierion (I score). The procedure requires the transformation of latency and error scores in to standard scores. The variable known I score was defined as the standard score for errors minus standard score latency ( I = Z error – Z latency). Accordingly, the subjects with negative I score form the reflective group and subject with positive "I" score form the impulsive group. On the basis of reading achievement and "I" score, 15 children for each Grade were selected as high reading achiever reflectives, high reading achievers impulsives, low reading achiever reflectives and low reading achievers impulsives. That is how 60 children in each Grade were selected and for all the three Grades the total number of subjects were 180 for the final study. Then the three dependant majors mentioned earlier were administered.*

*The tests were administered to the subjects in their respective schools. Permission for this was taken from the district inspector of schools as well as the Headmaster of the concerned school. The teachers also extended their co-operation in*

*this matter. The tests were administered by the author himself in a separate room provided by the Headmaster of the respective school. Maximum care was taken to keep the subject away from the external disturbances during the test administration.*

*Each subject was tested indivisually in three different sessions. During the first session Reading tests were administered to detect the high reading achievers and low reading achievers. After this session was over MFFT – 20 was administered to detect the subject's position in Reflective and impulsive cell. The rest of the tests were administered in the third session as per the order mentioned in earlier discussions. However, the number of test administered in third session varied from case to case depending on the time taken by the subjects to complete the tests and their willingness to take part in the process. Then after the test administration, class teachers are requested to rate the children in the seven points scale of SCRS (SCRS : 33items, SCRS : 7 items). The subjects competencies in different achievement tests (M.I.L., Oriya , Arithmetic, General Science, Social Studies and Drawing) were noted down from the school examiniation records.*

*The tests were administered by establishing adequate report with individual subject. The rules and instructions given in the test manuals were strictly followed. The subjects were tested individually in Oriya, the mother tongue of Orissa, and also the medium of instruction of schools from were the subjects were selected. Before administration of each test, the subjects were exposed to a few sample items. The purpose was to develop their acquaintance with the tests. The subjects were also encouraged to ask questions freely to the investigator, as they were told to do well in the test . At the end of the test session, the subjects were given some incentives as a token of appreciation of their participation in the processes. The subjects had shown deep involvement in their tasks.*

# CHAPTER - III
# RESULTS

*The data analyses are reported in three Major Sections. The first section deals with descriptive data on three major groups of dependent variables (Cognitive, Behavioural and Achievement).*

*The scond section deals with multivariate and Univariate Factor Analysis of variance (MANOVA and ANOVA) computed on the three major groups of dependent variables (Cognitive, Behavioural and Achievement).*

*The third section deals with correlational and Factor Analyses.*

**Table-1**

Descriptive Data (Mean and Standard Deviation) for High Reading Achievers and Low Reading Achievers on Different Cognitive Problem-Solving Measures, Behavioural Measures and Classroom Achievement Measures.

| Groups | | | High Reading Achievers (n=90) | | Low Reading Achievers (n=90) | |
|---|---|---|---|---|---|---|
| Variables | | | Mean | S.D. | Mean | S.D. |
| | R-I Dimension | MFFT 20 Errors | 24,25 | 9.86 | 39.77 | 10.41 |
| | | MFFT 20 Mean Latency | 11.85 | 5.39 | 10.64 | 5.06 |
| Cognitive Measures | Simultaneous Processing | R.C.P.M. Score | 20.27 | 5.84 | 20.09 | 5.24 |
| | | Fifure Copying Score | 14.56 | 5.92 | 10.34 | 4.92 |
| | | Figure Copying Mean Latency | 104.82 | 38.12 | 95.34 | 20.56 |
| | Successive Processing | Serial Recall | 85.68 | 10.16 | 65.01 | 10.25 |
| | | Digit Span Forward | 7.60 | 3.14 | 5.28 | 1.98 |
| | | Digit Span Backward | 5.44 | 2.02 | 2.88 | 0.96 |
| | Planning | Visual Search Total Score | 10.82 | 5.08 | 14.86 | 4.36 |
| | Classroom Behaviour Measures | Self Control Rating Scale : 33 Items | 150.48 | 40.85 | 139.25 | 37.08 |
| | | Self Control Rating Scale : 7 Items | 23.19 | 8.34 | 24.41 | 7.86 |
| | Classroom Achievement Measures | M.I.L..(O) | 49.38 | 17.86 | 37.06 | 16.12 |
| | | Arithmetic | 52.19 | 25.14 | 36.33 | 26.45 |
| | | S. Science | 51.00 | 18.26 | 36.63 | 15.58 |
| | | Social Studies | 49.08 | 18.93 | 38.43 | 18.76 |
| | | Drawing | 44.70 | 12.62 | 38.37 | 14.59 |

**Table - 2**

Descriptive Data (Mean and Standard Deviation) for
Reflective and Impulsive Groups on
Different Cognitive Problem-Solving Measures, Behavioural Measures,
and Classroom Achievement Measures.

| Groups | | | Reflective (n=90) | | Impulsive (n=90) | |
|---|---|---|---|---|---|---|
| Variables | | | Mean | S.D. | Mean | S.D. |
| Cognitive Measures | R-I Dimension | MFFT 20 Errors | 22.78 | 8.91 | 32.25 | 9.38 |
| | | MFFT20 Mean Latency | 13.79 | 4.86 | 8.71 | 4.03 |
| | Simultaneous | R.C.P.M. Score | 23.05 | 5.12 | 17.31 | 4.98 |
| | | Figure Copying Score | 13.68 | 5.35 | 11.15 | 5.86 |
| | Processing | Figure Copying Mean Latency | 105.18 | 30.24 | 94.98 | 28.96 |
| | Successive | Serial Recall | 84.88 | 9.55 | 83.47 | 9.93 |
| | | Digit Span Forward | 7.35 | 3.62 | 5.53 | 2.46 |
| | Processing | Digit Span Backward | 4.51 | 1.67 | 3.80 | 1.01 |
| | Planning | Visual Search Total Score | 12.17 | 5.62 | 13.59 | 4.15 |
| | Classroom Behaviour Measures | Self Control Rating Scale : 33 Items | 136.58 | 40.68 | 173.15 | 29.65 |
| | | Self Control Rating Scale : 7 Items | 26.09 | 8.56 | 21.51 | 6.73 |
| | Classroom Achievement Measures | M.I.L. (O) | 47.58 | 18.82 | 38.89 | 13.62 |
| | | Arithmetic | 50.03 | 23.54 | 39.84 | 24.69 |
| | | S. Science | 49.02 | 17.86 | 39.62 | 17.05 |
| | | Social Studies | 48.26 | 17.03 | 40.59 | 17.01 |
| | | Drawing | 45.88 | 14.31 | 37.19 | 13.62 |

## Table-3

Descriptive Data (Mean and Standard Deviation) for Grade-3, Grade-4, Grade-5 Children on Different Cognitive Problem-Solving Measures, Behavioural Measures, and Classroom Achievement Measures.

| Groups | | | Grade-3 (n=60) | | Grade-4 (n=60) | | Grade-5 (n=60) | |
|---|---|---|---|---|---|---|---|---|
| Variables | | | M | S.D. | M | S.D. | M | S.D. |
| Cognitive Measure | R-I Dimension | MFFT 20 Errors | 30.45 | 9.98 | 28.16 | 10.26 | 23.92 | 11.46 |
| | | MFFT 20Mean Latency | 9.38 | 5.01 | 11.28 | 5.31 | 13.08 | 5.65 |
| | Simultaneous Processing | R.C.P.M. Score | 17.85 | 4.76 | 20.64 | 4.87 | 22.05 | 6.18 |
| | | Figure Copying Score | 9.35 | 5.61 | 12.98 | 5.02 | 15.02 | 5.39 |
| | | Figure Copying Mean Latency | 104.08 | 33.21 | 91.12 | 30.94 | 105.04 | 29.15 |
| | Successive Processing | Serial Recall | 80.92 | 10.18 | 84.25 | 10.84 | 87.35 | 9.27 |
| | | Digit Span Forward | 5.33 | 1.46 | 6.45 | 1.54 | 7.54 | 2.35 |
| | | Digit Span Backward | 2.87 | 0.79 | 4.29 | 1.78 | 5.34 | 2.02 |
| | Planning | Visual Search Total Score | 13.94 | 3.52 | 12.85 | 3.77 | 11.73 | 3.42 |
| | Classroom Behaviour Measures | Self Control Rating Scale : 33 Items | 147.43 | 35.86 | 154.92 | 42.15 | 162.25 | 38.26 |
| | | Self Control Rating Scale : 7 Items | 25.18 | 9.54 | 24.86 | 10.24 | 21.36 | 7.45 |
| | Classroom Achievement Measures | M.I.L. (O) | 50.27 | 14.95 | 41.07 | 16.12 | 38.36 | 12.63 |
| | | Arithmetic | 59.90 | 21.85 | 43.08 | 16.23 | 36.53 | 36.32 |
| | | G. Science | 52.13 | 14.15 | 43.08 | 16.23 | 36.23 | 17.9 |
| | | Social Studies | 49.93 | 15.04 | 42.68 | 20.64 | 38.65 | 18.51 |
| | | Drawing | 36.97 | 14.37 | 40.68 | 12.50 | 46.95 | 18.64 |

## Table - 4

Descriptive Data (Mean and Standard Deviation) for Grade-3 Children on Different Cognitive Problem-Solving Measures, Behavioural Measures and Classoom Achievement Measures.

| Groups / Variables | | | | High Reading Achieves | | Low Reading Achieves | |
|---|---|---|---|---|---|---|---|
| | | | | Reflectives (n=15) | Impulsive (n=15) | Refletives (n=15) | Impulsives (n=15) |
| | R-I Dimension | MFFT20 Errors | M | 24.29 | 32.35 | 27.86 | 37.30 |
| | | | SD | 9.08 | 6.14 | 9.82 | 8.52 |
| | | MFFT20 Mean Latency | M | 13.65 | 8.25 | 11.15 | 4.47 |
| | | | SD | 6.02 | 3.14 | 3.86 | 2.03 |
| | Simultaneous Processing | R.C.P.M. Score | M | 21.08 | 15.76 | 21.18 | 13.38 |
| | | | SD | 4.92 | 2.41 | 5.17 | 4.28 |
| | | Figure Copying Score | M | 11.25 | 9.65 | 9.06 | 7.44 |
| | | | SD | 5.35 | 5.92 | 4.71 | 5.06 |
| | | Figure Copying Mean Latency | M | 128.62 | 96.00 | 87.23 | 104.47 |
| | | | SD | 30.46 | 39.82 | 20.14 | 18.12 |
| | Successive Processing | Serial Recall | M | 82.65 | 81.37 | 81.34 | 78.32 |
| | | | SD | 9.13 | 12.34 | 10.02 | 8.94 |
| | | Digit Span Forward | M | 6.02 | 6.94 | 6.35 | 2.01 |
| | | | SD | 2.04 | 1.98 | 1.84 | 1.63 |
| | | Digit Span Backward | M | 3.26 | 4.44 | 2.05 | 1.73 |
| | | | SD | 1.33 | 1.32 | 0.84 | 0.56 |
| | Planning | Visual Search Total Score | M | 12.95 | 10.35 | 13.85 | 18.61 |
| | | | SD | 3.08 | 3.14 | 3.23 | 3.86 |
| | Classroom Behaviour Measures | Self Control Rating Scale : 33 Items | M | 132.65 | 171.27 | 133.16 | 152.64 |
| | | | SD | 36.58 | 33.49 | 25.14 | 28.06 |
| | | Self Control Rating Scale : 7 Items | M | 28.95 | 19.61 | 29.91 | 22.25 |
| | | | SD | 15.12 | 5.03 | 7.41 | 7.83 |
| | Classroom Achievement Measures | M.I.L. (O) | M | 59.85 | 49.05 | 48.64 | 43.54 |
| | | | SD | 19.03 | 10.46 | 15.78 | 9.24 |
| | | Arithmetic | M | 60.28 | 58.22 | 48.17 | 46.93 |
| | | | SD | 25.42 | 23.14 | 22.67 | 19.28 |
| | | G. Science | M | 59.64 | 53.38 | 49.25 | 46.25 |
| | | | SD | 15.24 | 15.87 | 12.36 | 11.78 |
| | | Social Studies | M | 55.02 | 53.22 | 49.16 | 42.32 |
| | | | SD | 18.64 | 15.23 | 16.86 | 18.45 |
| | | Drawing | M | 48.25 | 33.11 | 35.59 | 30.93 |
| | | | SD | 18.39 | 15.66 | 15.29 | 10.14 |

## Table - 5

Descriptive Data (Mean and Standard Deviation) for Grade-4 Children on Different Cognitive Problem-Solving Measures, Behavioural Measures and Classoom Achievement Measures.

| Groups / Variables | | | | High Reading Achieves | | Low Reading Achieves | |
|---|---|---|---|---|---|---|---|
| | | | | Reflectives (n=15) | Impulsive (n=15) | Refletives (n=15) | Impulsives (n=15) |
| Cognitive Measures | R-I Dimension | MFFT20 Errors | M | 21.34 | 29.62 | 24.06 | 37.68 |
| | | | SD | 5.78 | 8.92 | 9.25 | 8.63 |
| | | MFFT20 Mean Latency | M | 13.85 | 10.07 | 12.38 | 8.82 |
| | | | SD | 4.15 | 5.06 | 5.02 | 3.01 |
| | Simultaneous Processing | R.C.P.M. Score | M | 23.58 | 18.52 | 23.15 | 17.31 |
| | | | SD | 3.98 | 4.82 | 4.18 | 5.43 |
| | | Figure Copying Score | M | 16.12 | 14.20 | 13.25 | 8.35 |
| | | | SD | 5.31 | 3.94 | 4.01 | 4.58 |
| | | Figure Copying Mean Latency | M | 100.85 | 79.09 | 97.12 | 87.42 |
| | | | SD | 31.94 | 30.67 | 26.18 | 16.04 |
| | Successive Processing | Serial Recall | M | 83.68 | 87.56 | 85.36 | 80.40 |
| | | | SD | 11.28 | 10.97 | 10.08 | 10.94 |
| | | Digit Span Forward | M | 8.24 | 7.14 | 6.51 | 3.91 |
| | | | SD | 2.16 | 2.14 | 1.45 | 1.32 |
| | | Digit Span Backward | M | 6.28 | 5.22 | 3.92 | 1.56 |
| | | | SD | 1.02 | 1.23 | 0.97 | 0.92 |
| | Planning | Visual Search Total Score | M | 9.86 | 11.50 | 14.16 | 15.88 |
| | | | SD | 3.01 | 3.59 | 4.65 | 4.27 |
| Classroom Behaviour Measures | | Self Control Rating Scale : 33 Items | M | 131.78 | 1173.44 | 144.87 | 169.59 |
| | | | SD | 42.86 | 23.68 | 42.74 | 32.95 |
| | | Self Control Rating Scale : 7 Items | M | 30.98 | 15.66 | 29.18 | 26.62 |
| | | | SD | 8.62 | 6.34 | 7.05 | 7.18 |
| Classroom Achievement Measures | | M.I.L. (O) | M | 52.42 | 36.88 | 39.25 | 35.73 |
| | | | SD | 14.95 | 12.18 | 15.02 | 15.94 |
| | | Arithmetic | M | 60.25 | 33.85 | 42.65 | 36.69 |
| | | | SD | 30.38 | 21.20 | 26.05 | 25.02 |
| | | G. Science | M | 55.34 | 37.14 | 40.65 | 39.19 |
| | | | SD | 15.09 | 12.48 | 15.67 | 13.04 |
| | | Social Studies | M | 56.28 | 31.02 | 42.34 | 41.08 |
| | | | SD | 14.29 | 16.31 | 20.88 | 16.35 |
| | | Drawing | M | 50.18 | 40.38 | 44.65 | 27.51 |
| | | | SD | 11.85 | 15.63 | 14.32 | 14.81 |

## Table - 6

Descriptive Data (Mean and Standard Deviation) for Grade-4 Children on Different Cognitive Problem-Solving Measures, Behavioural Measures and Classoom Achievement Measures.

| Groups / Variables | | | | High Reading Achieves | | Low Reading Achieves | |
|---|---|---|---|---|---|---|---|
| | | | | Reflectives (n=15) | Impulsive (n=15) | Refletives (n=15) | Impulsives (n=15) |
| Cognitive Measures | R-I Dimension | MEFZT20 Errors | M | 17.06 | 20.84 | 22.05 | 3573 |
| | | | SD | 7.27 | 5.24 | 10.12 | 9.36 |
| | | MEFT20 Mean Latency | M | 16.84 | 8.44 | 14.86 | 12.18 |
| | | | SD | 4.02 | 3.41 | 4.52 | 4.31 |
| | Simultaneous Processing | R.C.P.M. Score | M | 25.38 | 17.32 | 23.95 | 21.55 |
| | | | SD | 4.52 | 5.04 | 5.46 | 5.96 |
| | | Figure Copying Score | M | 19.36 | 16.76 | 13.05 | 10.91 |
| | | | SD | 5.01 | 4.06 | 5.28 | 5.03 |
| | | Figure Copying Mean Latency | M | 118.55 | 105.79 | 98.69 | 97.13 |
| | | | SD | 32.78 | 26.52 | 25.93 | 21.08 |
| | Successive Processing | Serial Recall | M | 89.07 | 89.77 | 87.16 | 83.40 |
| | | | SD | 8.12 | 6.32 | 9.63 | 9.04 |
| | | Digit Span Forward | M | 9.86 | 7.38 | 7.14 | 5.78 |
| | | | SD | 2.14 | 1.84 | 1.72 | 1.97 |
| | | Digit Span Backward | M | 7.242 | 6.18 | 4.25 | 3.69 |
| | | | SD | 1.21 | 0.98 | 1.01 | 0.82 |
| | Planning | Visual Search Total Score | M | 9.84 | 10.96 | 12.38 | 14.26 |
| | | | SD | 4.02 | 3.48 | 4.18 | 3.51 |
| | Classroom Behaviour Measures | Self Control Rating Scale : 33 Items | M | 116.76 | 176.98 | 160.24 | 195.02 |
| | | | SD | 42.28 | 27.89 | 35.24 | 31.62 |
| | | Self Control Rating Scale : 7 Items | M | 20.65 | 23.31 | 19.86 | 21.62 |
| | | | SD | 6.94 | 6.02 | 7.43 | 6.04 |
| | Classroom Achievement Measures | M.I.L. (O) | M | 52.98 | 45.42 | 32.64 | 22.7 |
| | | | SD | 14.67 | 11.14 | 10.94 | 8.07 |
| | | Arithmetic | M | 58.25 | 52.31 | 34.55 | 9.01 |
| | | | SD | 23.61 | 21.32 | 21.04 | 22.31 |
| | | G. Science | M | 55.60 | 50.96 | 33.63 | 10.79 |
| | | | SD | 22.68 | 16.84 | 12.88 | 12.34 |
| | | Social Studies | M | 52.45 | 54.47 | 34.28 | 21.04 |
| | | | SD | 20.15 | 14.76 | 12.98 | 12.91 |
| | | Drawing | M | 50.08 | 46.20 | 46.52 | 45.00 |
| | | | SD | 17.63 | 15.68 | 15.34 | 11.23 |

## Table - 7

Summary of Analysis of Variance on Different Cognitive Measures

| Varables | | A F | B F | C F | AB F | AC F | BC F | ABC F |
|---|---|---|---|---|---|---|---|---|
| R-1 Dimesion | MFFT20 Error | 22.63**** | 72.48**** | 8.42*** | 2.47 | 1.88 | <1 | 1.62 |
| | MFFT20 Mean Latency | 2.74 | 79.84**** | 6.29 | <1 | <1 | <1 | <1 |
| Simultaneous Processing | R.C.P.M.Score | <1 | 49.27*** | 6.54** | 1.74 | <1 | <1 | <1 |
| | Figure Copying Score | 22.86**** | 8.06**** | 12.96 **** | <1 | 1.28 | <1 | <1 |
| | Figure Copying Mean Latency | 14.23**** | 4.74* | 5.48** | 2.54 | 3.91 | <1 | <1 |
| Successive Processing | Serial Recall | 18.65**** | <1 | 4.87** | <1 | <1 | <1 | <1 |
| | Digit Span Forward | 11.38**** | 4.27 | 2.76 | <1 | <1 | <1 | <1 |
| | Digit Span Backward | 13.69**** | 2.18 | 2.94 | <1 | <1 | <1 | <1 |
| Planning | Visual Search Total Score | 18.01**** | 2.24 | 1.44 | <1 | <1 | <1 | <1 |

* P <.5

** P <.01

*** P<.005

**** P<.001

**Note :-** A 2 X 2 X 3 Factorial Analysis of Variance was performed for each of the cognitive problem solving measures. The three factore were : A - Reading Achievement with Two levels (High Reading Achierers/Low Reading Achievers), B- Information Processing with two levels (Reflective/Impulsive) and C-Grade with three levels (Grade-3, Grade-4, and Grade-5).

## Cognitive Problem Solving Measures

*The dependent measures used here for analysis are divided in to three broad categories. The first category of dependent variable included cognitive problem solving measures (i.e MFFT20 Errors, MFT20 mean latency, R.C.P.M. score, Figure copying score, Figure copying mean latency, Serial Recall, Digit Span Forward, Digit Span Backward, Visual Search total Score). A preliminary multivariate analysis of variance (MANOVA) was conducted on the first category. The MANOVA indicated that the Hotelling Lawely Trace was statistically significant for reading achievement, F approximation (df = 24,169) = 10.16 P < .001, of the 9 dependent variables 7 were found to reach statistical significance in the univariate Anova. These variables were MFFT20 Errors, Figure copying score, Figure copying mean latency, Serial Recall, Digit Span Forward, Digit Span Backward, and visual search total score. Further Hotelling Lawely Trace was statistically significant for information processing, F approximation (df =24,149) = 8.62, P < .001 of the 9 dependent variables 7 were found to reach statistical significance in the univariance ANOVA. These variables were MFFT20 Error, MFFT20 mean latency, R.C.P.M. score, Figure copying score, Figure copying mean latency, Digit Span Forward, and visual search total score. The Hotelling Lawley Trace was also found statistically significant for the grade, F approximation (df = 48,149) = 6.14, P < .001, of the 9 dependent variables 7 were found to be statistically significant in univariate ANOVA. The variables were MFFT20 Error, MFFT20 mean latency, R.C.P.M. score, Figure copying score, Figure copying mean latency, Serial recall, and visual search total score. The non-significant results were obtained for reading achievement by information processing, Reading acievement by grade, information processing by grade; and reading achievement, by information processing by grade interaction effects.*

**MFFT20 Errors :**

*The factorial analysis of variance (ANOVA) conducted on MFFT 20 errors revealed statistically significant main effects for the reading achievement, F (1,168) = 22.63, P < .001, for information processing, F (1,168)=72.48, P <.001, and for grade, F (2.168) = 8.42, P <.005. The low reading achievers committed more errors (M=30.77, SD=10.42) compared to high reading achievers (M=24.25, SD=9.86). The mean errors for reflective children were found to be 22.78 (SD=8.91) where as the mean errors for the impulsive children were found to be 32l25 (SD=9.38). So far grade is concerned, the mean errors rate for grade-3, grade-4 and grade-5 children were found to be 30.45(SD=9.88), 25.16(SD=10.26), 23.92(SD=11.46) respectively. There was no statistically significant interaction effect between reading achievement and information processing reading achievement and grade, information processing and grade. There was also no three way interaction effect among the independent variables. In the absence of any interaction the finding indicated that reading achievement, information processing and grade variables were independently influencing the MFFT 20 errors.*

**MFFT20 Mean Latency :**

*The factorial analysis of variance (ANOVA) conducted on MFFT 20 mean latency revealed statistically significant main effects for information processing, F (1,168) = 79.84, P <.001; and for grade F (2,168) = 6.29, P<.01. The mean latency for reading high achievers were 11.85 (SD=5.39) and for low reading achievers were 10.64 (SD=5.06). The reflectives have more latency 13.79 (SD=4.86), compared to the impulsives 8.71 (SD=4.03). Taking grade in to account the mean latency score for grade-3, grade-4 and grade-5 children were found to be 9.38 (SD=5.01), 11.28 (SD=5.65) respectively. There was no statistically significant interaction effect between reading achievement and information processing, reading achievement and grade, information processing and grade. There was also no three way interaction of*

*main effects were found. In the absence of any interaction effect and main effect of reading achievement the result indicated that, the MFFT 20 mean latency score was independently influenced by informational processing and grade.*

**Raven's Coloured Progressive Matrices (R.C.P.M.) :**

*The factorial ANOVA on R.C.P.M. response indicated a statistically significant main effects for information processing, F (1,168) 49.27, P <.001 ; and for grade, F (2,168) = 6.54, P <.01. The main effect reading achievement was influencing insignificantly to the RCPM scores. The mean correct response scores on RCPM for high reading achievers and low reading achievers were 20.27 (SD=5.84), 20.09 (SD=5.12) respectively. The mean scores for reflective children was 23.05 (SD=5.12) and for impulsive children was 17.31 (SD=4.98). The grade-3, grade-4 and grade-5 children showed a trend of increased response scores in the order as grade-3 mean was 17.85 (SD=4.76), grade-4 mean was 20.64(SD=4.87), grade-5 mean was 22.05(SD=6.18). There was no statistically significant interaction effect between reading achievement and information processing, information processing and grade, grade and reading achievement. There was also no three-way interaction of main effects were found. In the absence of any interaction effect and main effect of reading achievement, the result indicated that, the RCPM response score was independently influenced by information processing and grade.*

**Figure Copying (Scores) :**

*The factorial ANOVA conducted on Figure Copying (Scores) indicated a statistically significant main effects for reading achievement, F (1, 168) = 22.86, P < .001 ; for information processing F, (1,168) = 8.06, P < .001 ; for grade F, (2,168) = 19.26, P < .001. The high reading achievers scored more (M = 14.56, SD = 5.92) than the low reading achievers (M = 10.34, SD = 4.92) in figure copying score. In the information processing the reflectives have better position (M = 13.68, SD = 5.85) compared to the impulsives (M = 11.15, SD = 5.86). So far grade is concerned a*

*increasing pattern grade difference was observed. The Grade –3 children have (M = 9.35, SD = 5.61), the Grade – 4 children (M = 12.98, SD = 5.02) and Grade – 5 children (M = 15.02, SD = 5.39) have in Figure copying score. No two –way or three-way interaction of main effects was observed for Figure copying score. So the result indicates that reading achievement, information processing and grade main effects were independently influencing the figure copying scores.*

**Figure Copying (Mean Latency) :**

*The factorial ANOVA on figure copying mean latency scores resulted in the statistically significant findings for main effects of reading achievement, F, (1,168) = 14.23, P < .001, for information processing, F, (1,168) = 4.74, P < .05, and for grade F, (1,168) = 5.48, P < .01. The high reading achievers were taking more time for figure copying (M = 104.82, SD = 38.12) compared to low reading achievers (M = 95.34, SD = 20.56). Similarly, the mean time score of the reflective children were found to be more (M = 105.18, SD = 30.24) than the impulsive children (M = 94.98, SD = 28.96). For the grade main effect a low score for Grade – 4(M = 91.12, SD = 30.94) was observed compared to Grade – 3 (M = 104.08 Sd = 33.21) and Grade – 5 (M = 105.04, SD = 29.15) children's Figure copying (mean latency) score. There is no statistically significant two-way or three-way interaction of main effects was observed. So the result shows that the main effects reading achievement, information processing and grade independently influencing the figure copying (mean latency) score.*

**Serial Recall :**

*The factorial ANOVA Serial Recall response scores revealed statistically significant main effects for reading achievement, F, (1,168) = 18.65, P < .001, and for grade, F, (2,168) = 4.87, P < .01, and no significant result was observed for information processing. The mean Serial Recall score for high reading achievers and low reading achievers were : (M = 85.68, SD = 10.16) and (M=65.01, Sd = 10.25) respectively. The reflectives and impulsives possesses almost nearer mean score (M =*

*84.88, SD = 9.55), and (M = 83.47, SD = 9.93) in Serial Recall response scores respectively. The mean serial recall score for Grade – 3, Grade – 4and Grade – 5 children were found to be 80.92 (SD = 10.18), 84.25 (SD = 10.84), 87.35 (SD = 9.27) respectively. There is also no significant two-way, or three-way interaction of main effects were observed. So the result concludes that the reading achievement and grade independently influence the serial recall score.*

**Digit Span Forward :**

*The factorial ANOVA conducted in the Digit Span Backward total scores revealed a statistically significant main effect for the reading achievement, F, (1,168) = 11.38, P < .001, for information processing F, (1,168) = 4.27, P < .05, for grade, no significant effect ws observed. The mean digit span forward score high reading achievers and low reading achievers were found as 7.60 (SD = 3.14) and 5.28 (SD = 1.98) respectively. The reflectives have high score (M = 7.35, Sd = 3.62) compared to the impulsives (M=5.53, SD = 2.46). The mean score for grade –3, grade – 4 and grade – 5 children were found to be 5.33 (SD = 1.46), 6.45 (SD = 1.54), 7.54 (SD = 2.35) respectively. There is no two-way or three-way interaction of main effects were found to be significant in this test. So the result concludes that the reading achievement and information processing independently influence the digit span forward score.*

**Digit Span Backward :**

*The factorial ANOVA conducted on the Digit Span Backward total scores revealed a statistically significant main effect for the reading achievement, F, (1,168) = 13.69 P < .001. There is no significant main effect for information processing and grade was found in the digit span backward total score. The mean total score for high reading achievers and low reading achievers were (M=5.44, Sd = 2.02) and (M=2.88, SD = .96) respectively. The reflective mean score was (M = 4.51, Sd = 1.67) and impulsives mean score ws (M=3.80, Sd = 1.01). The mean score for grade –3, grade –*

*4 and grade –5 children were found to be 2.87 (SD = .79), 4.26 (SD = 1.78), 5.34 (Sd = 2.02) respectively. There is not two-way or three-way interaction of main effects were found to be significant in this test. So the result shows that the reading achievement is the only main effect independently influence the digit span backward total score.*

## Visual Search Test :

*The factorial ANOVA for visual search total score revealed statistically significant main effects for reading achievement, F, (1,168) = 18.01, P < .001. There was no statistically significant P value for information processing and grade main effects. The mean visual search total score for high reading achievers and low reading achievers were (M=10.82, Sd = 5.08) and (M=14.86, SD = 4.36) respectively. The reflectives and impulsives mean score were ; (M=12.17, SD = 5.62) and (M=13.59, SD=4.15) respectively. The mean total score for grade-3, grade-4 and grade-5 were found to be 13.94 (SD = 3.52), 12.85 (SD = 3.77), 11.73 (SD=3.42) respectively. There is also no significant two-way or three-way interaction of main effects were observed. So the result shows that reading achievement was the only main effect independently influence the visual search total score.*

Table – 8

Summary of Analysis of Variance for
Teacher Ratings of Classroom Behavioural Measures

| Variables | A | B | C | AB | AC | BC | ABC |
|---|---|---|---|---|---|---|---|
| | F | F | F | F | F | F | F |
| Self - Control Rating Scale : 33 items | 21.18 | 30.14**** | 2.98 | 3.14 | <1 | <1 | <1 |
| Self – Control Rating Scale: 7 items | <1 | 23.56**** | 2.46 | 3.85 | 2.46 | <1 | <1 |

* $P < .05$

** $P < .01$

*** $P < .005$

**** $P < .001$

*Note : A 2 X 2 X 3 Factorial Analysis of Variance was performed for the classroom Behaviour Measures. The three factors were : A – Reading Achievement with Two levels (High Reading Achievers / Low Reading Achievers), B – Information processing with two levels (Reflective / Impulsive) C – Grade with three levels (Grade –3, Grade 4 and Grade-5).*

## Teacher Rating of Classroom Behaviour

*The second category of dependent variable included the teacher ratings of classroom behaviour measures, (i.e. the self-control Rating Scale).*

### Self Control Rating Scale (SCRS) :

*The factorial ANOVA on SCRS scores for 33 items and for 7 items were made. In both the cases statistically significant main effect was revealed for information processing and no such result was found for the main effects of reading achievement and grade. In information processing for 33 items, $F$, (1,168) = 30.14, $P$ < .001, and for 7 items, $F$, (1,168) = 23.56, $P$ < .001. The mean score for reflective children in SCRS; 33 items was 136.58 (SD = 40.68), where as for impulsives was 173.15 (SD=29.65). The mean score for reflective children in SCRS; 7 items was 26.09 (SD=8.56), where as for impulsives was 21.51 (SD=6.73). It was also observed that no significant two-way or three-way interaction of main effects were obtained from the analysis of results of the present rating scores. So the result confirmed that information processing had contributed independently to the attainment of rating scores ; that shows reflectives are better rated than the impulsive children.*

*Table – 9*

*Summary of Analysis of Variance on Different Classroom Achievements Measures*

| *Variables* | *A* | *B* | *C* | *AB* | *AC* | *BC* | *ABC* |
|---|---|---|---|---|---|---|---|
| | *F* | *F* | *F* | *F* | *F* | *F* | *F* |
| *M.I.L (O)* | *23.48* **** | *19.63* **** | *26.58* **** | *3.74* | *<1* | *<1* | *1.57* |
| *Arithmetic* | *25.61* **** | *21.58* **** | *24.18* **** | *3.98* | *<1* | *2.08* | *1.42* |
| *G. Science* | *24.39* **** | *20.26* **** | *24.25* **** | *2.26* | *<1* | *<1* | *1.51* |
| *Social Studies* | *22.63* **** | *18.14* **** | *25.78* **** | *1.31* | *1.42* | *1.38* | *<1* |
| *Drawing* | *14.26* **** | *17.28* **** | *22.48* **** | *<1* | *2.68* | *<1* | *<1* |

* $P < .05$

* $P < .01$

*** $P < .005$

**** $P < .001$

*Note : A 2 X 2 X 3 Factorial Analysis of Variance was performed for the classroom Behaviour Measures. The three factors were : A – Reading Achievement with Two levels (High Reading Achievers / Low Reading Achievers), B – Information processing with two levels (Reflective / Impulsive) C – Grade with three levels (Grade –3, Grade 4 and Grade-5).*

## Classroom Achievement Measures

*The third category of dependent variables included the classroom achievement measure (i.e. M.I.L. (O), Arithmetic, General Science, Social Studies and Drawing. The MANOVA indicated that the Hotelling Loley Trace was statistically significant for reading achievement, F approximation ( dF = 24,167) = 8.12, P < .001; for R – I information processing, F approximation ( dF = 24,167) = 8.92, P < .001 and for grade, F approximation ( dF = 24,167) = 7.64, P < .001. All the dependent variables are found to be statistically significant in the univariate ANOVA for reading achievement. The same result was also revealed for information processing and grade. No significant results were obtained for reading achievement by information processing, reading achievement by grade, information processing by grade, and reading achievement by information processing by grade interaction effects.*

**M.I.L. (Oriya) :**

*The factorial ANOVA on M.I.L. (O) revealed a statistically significant main effects for reading achievement, F (1, 168) = 23.48, P < .001, for information procesing, F (1,168) = 19.63, P < .001, and for grade F (2, 168) = 26.58, P < .001. No interaction effect was found to be significant which indicated that, reading achievement, information processing and grade main effects independently influence the language competencies. From the result table it was observed that the high reading achievers are well placed (M = 49.38, Sd = 17.86) the low reading achiever, (M = 37.08, SD = 16.12). The reflectives scored high (M = 47.58, SD = 18.82) than the impulsives (M = 38.89, Sd = 13.62). By concentrating on the grade factor, it was observed a reverse pattern as grade – 3 did better (M=50.27, Sd = 14.95), than grade – 4 (M=41.07, SD = 16.12), and grade – 5 (M=38.36, SD = 12.63). So the grade – 3 children shows better language competencies in comparison to grade – 4 and grade – 5.*

Arithmetic :

*The factorial ANOVA on Arithmetic achievement score indicated the statistically significant main effect for reading achievement F (1, 168) = 25.61, P < .001, for information processing, F (1, 168) = 21.58, P < .001, and for grade F (2, 168) = 24.18, P < .001. The reading high achievers scored well (m=52.19, SD = 25.14) than the low reading achievers (M=36.33, SD = 2645). The reflectives are also scored well (M=50.03, SD = 23.54), than the impulsives (M=39.84, SD = 24.69). In the Arithmetic achievement the reverse trend was observed, the grade – 3scored (M=52.90, Sd = 21.85) better than grade – 4 (M=43.36, Sd = 17.84) and grade – 5(M=36.53, SD = 30.32). There is no significant two – way or three – way interaction of main effects were observed. The result concludes that reading achievement, information processing and grade main effects independently influence the arithmetic achievement competencies of the children.*

General Science :

*The factorial ANOVA conducted on General Science achievement score indicated the statistically significant main effect for reading achievement F (1, 168) = 24.39, P < .001, for information processing, F (1, 168) = 20.26, P < .001, and for grade F (2, 168) = 24.25, P < .001. The high reading achievers were performed better (M=51.00, SD = 18.26) than the low reading achievers (M=36.62, SD = 15.58). The reflectives are also better (M=49.02, Sd = 17.86), than the impulsives (M=39.62, SD = 17.05). The grade main effect are in reverse order as grade – 3(M=52.13, Sd = 14.15) secured highest in comparison to grade – 4(M=43.08, SD = 16.23) and grade – 5 (M=36.23, Sd = 17.96). There is no significant tow-way or three – way interaction of main effects were observed. So the result revealed that reading achievement, information processing and grade independently influence the General Science performance of the children.*

**Social Studies :**

*The factorial ANOVA on social studies scores revealed the statistically significant main effects for reading achievment, F (1,168) = 22.63, P <.001, for information processing, F (1.168) = 18.14, P <.001, and grade, F (2,168) = 25.78, P <.001. The high reading achievers were performed better (M = 49.08), SD = 18.93) than the low reading achievers (M = 38.43, SD = 18.76). The reflectives performance also better (m = 48.26, SD = 17.03) than the impulsives (M = 40.59, SD = 17.01). The Grade-3 children scored more (M = 49.93, SD =15.04) than Grade-4 (M = 42.68, SD = 20.64) and Grade – 5 (M = 38.65, SD = 18.51). There is no significant two-way or three-way interaction of main effects were observed. So the result revealed that reading achievement, information processing and grade independently influence the social studies achievement performance of the children.*

**Drawing :**

*The factorial ANOVA concluded on the drawing scores revealed the statistically significant main effects for reading achievement, F (1,168) = 14.26, P <.001, for information processing, F (1,168) = 17.28, P <.001, and for Grade, F (2,168) = 22.48, P <.001. The high reading achievers have better performance (M=44.70, SD=12.62) than the low reading achievers (M=38.37, SD=14.59). The reflectives score was (M=45.88, SD=14.31) and impulsives score was (M=37.19), SD=13.62). The mean score for Grade-3, Grade-4 and Grade-5 were, 36.97 (SD=14.37), 40.68 (SD=12.50), 46.95 (SD=18.64) respectively. There are no significant two-way or three-way interaction of main effects were observed. So the result revealed that reading achievement, information processing and grade independently influence the drawing.*

Summary :

*The main effects of reading achievement had independent influence on majority of cognitive problem-solving measures (i.e. MFFT20errors, Figure, copying score, Figure copying mean latency, Serial Recall, Digit Span Forward, Digit Span Backward and Visual Search total score) and al the classroom achievement measures. But reading achievement did not show any independent influence on classroom Behaviour Measure (i.e. SCRS : 33 items & 7 items). The main effect of information processing had independent influence on a set of cognitive problem solving measures (i.e. MFFT20 Errors, MFFT20 mean latency , R.C.P.M. score, Figure copying score, Figure copying mean latency, and on Classroom Behaviour Measure (i.e. SCRS : 33 items & 7 items), and also in the classroom achievement measures. The main effect of grade had independent influence on a set of cognitive problem solving measures (i.e MFFT20 Error, MFFT mean latency, R.C.P.M. score, Firgure copying score, Figure copying mean latency, Serial Recall and on all the classroom achievement measures. But did not show any independent influence on class room Behaviour Measures (i.e. SCRS : 33 items & 7 items).*

*The high reading achievers out performed the low reading achievers on all the cognitive problem solving measures and achievement measures. The high reading achievers performance in MFFT20 revealed, less errors with more latency. The reverse was the happening with low reading achievers, the more error with less time. On the mean RCPM score and MFFT20 mean latency Score both the groups are very nearer. On the other-hand, the classroom behavioural measure of teacher ratings the achievers are not better rated compared to the low reading achievers.*

*The reflectives are better placed compared to the impulsives. They establish superiority on all cognitive problem solving measures, behavioural measures and classroom achievement measures. But a closer look revealed that both the groups are comparable in serial recall and digit span backward, and visual search total score. In MFFT20 the reflectives committed less error spending more time, where as the*

*impulsive are in reverse committing more error by spending less time. On the teacher ratings Behavioural Measures, the reflective children. The reflective children were also found to be more motivated in academic sphere as the SCRS ratings for 7 items shows.*

*The grade difference indicated that the Grade-5 children are better placed on all the cognitive problem solving tasks compared to Grade-4 and Grade-3 children. There is a decreasing trend in cognitive problem solving scores from Grade-5 to Grade-4, and from Grade-4 to Grade-3. The behaviour measure shows that the Grade-5 children are highly motivated but are not better rated compared to Grade-4 and Grade-3. Taking classroom achievement measures into account, the Grade-5 showed a lower percentage of marks compare to Grade-4, and Grade-4 to Grade-3. So the percentage of marks showed a decline trends from Grade-3 to Grade-5. But in drawing the Grade-3 children scored less percentage than Grade-4 and Grade-4 scored less percentage than Grade-5. So lowest mark was observed for the Grade-3 children in drawing.*

## Table-10

## The Pearson's Products Moment Inter Correlation Matrix for the Scores on All the Cognitive Processing Variables for Grade-3 Children (n=60).

| Variables | MFFT20 Errors | MFFT20 Mean Latency | R.C.P.M. Scrore | Figure Copying Score | Figure Copying Mean Latency | SeriaL Recall | Digit Span Forward | Digit Span Backward | Visual Search Total Score |
|---|---|---|---|---|---|---|---|---|---|
| *MFFT20 Errors* | | | | | | | | | |
| *MFFT20 Mean latency* | *-.34* | | | | | | | | |
| *R.C.P.M Score* | *-.46* | *.31* | | | | | | | |
| *Figure Copying Score* | *-.19* | *.26* | *.32* | | | | | | |
| *Figure Copying Mean Latency* | *.005* | *-.06* | *.03* | *.14* | | | | | |
| *Serial Recall* | *-.17* | *.25* | *.32* | *.13* | *-.06* | | | | |
| *Digit Span Forward* | *-.25* | *.30* | *.12* | *.02* | *-.19* | *.55* | | | |
| *Digit Span Backward* | *-.13* | *-.16* | *-.17* | *.10* | *-.07* | *.28* | *.44* | | |
| *Visual Search Total Score* | *.16* | *-.19* | *-.25* | *.01* | *-.01* | *.29* | *.24* | *.19* | |

*For P <.05 Critical = .25*

*For P <.01 Critical = .33*

## Pearson's Product Moment Intercorrelation

### Grade- 3

*The Table-10 present's product moment intercorrelation matrix for the scores on all 9 cognitive problem solving variabls for Grade-3 children. The degree of freedom (df) for all the variables was 58. The matrix table shows that a significant negative relationship was found between MFFT20 Errors, and MFFT20 mean latency ($\underline{r}$ = -.34, $\underline{P}$ <.01), R.C.P.M. score ($\underline{r}$ = -.46. $\underline{P}$ <.01), Digit span forward ($\underline{r}$ = -.25, $\underline{P}$<.05). The MFFT20 errors has positive relationship with figure copying latency (.01) and visual search (.16). The negative relationship with figure copying score (-.19). Serial Recall (-.17) and Digit Span backward (-.13). The MFFT20 mean latency showed a signifcant positive relationship with RCPM score ($\underline{r}$ = -.31. $\underline{P}$ <.05), Figure copying score ($\underline{r}$ = .30. $\underline{P}$ <.05), Serial Recall ($\underline{r}$ = -.25. $\underline{P}$ <.05), and Digit Span Forward ($\underline{r}$ = -.30. $\underline{P}$ <.05). The MFFT20 mean latency has negative relationship with figure copying latency (-.06), Digit Span Backward (-.16) and Visual search total score (-.19). The R.C.P.M. score has a significant positive relation with Figure copying score ($\underline{r}$ = -.32. $\underline{P}$ <.05), Serial Recall, ($\underline{r}$ = -.32. $\underline{P}$ <.05), and visual search total score ($\underline{r}$ = -.25. $\underline{P}$ <.05). The RCPM score relationship with Figure copying latency (.03), Digit Span forward (.12) and Digit Span backward (-.17). The figure copying score has a set of positive relationship with Figure copying mean latency (.14), Serial recall (.13), Digit Span forward (.02), Digit Span backward (.10) and with visual search (.01). The Figure copying mean latency established negative relationship with Serial recall (-.06), Digit Span forward (-.19), Digit Span Backward (.07), and visual search (-.01). Serial recall has established significant positive relationship with Digit Span forward ($\underline{r}$ = -.28. $\underline{P}$ <.05) and with visual search total score ($\underline{r}$ = -.29. $\underline{P}$ <.05). The Digit Span backward ($\underline{r}$ = -.44. $\underline{P}$ <.01) and also positive relation of (.24) with visual search. The Digit Span Backward established a positive (.19) relation with visual search total score.*

sTable-11

**The Pearson's Product Moment Inter Correlation Matrix for the Scores on All the Cognitive Processing Variables for Grade-4 Children (n=60)**

| Variables | MFFT 20 Errors | MFFT20 Mean Latency | R.C.P. M. Scrore | Figure Copying Score | Figure Copying Mean Latency | SeriaL Recall | Digit Span For - ward | Digit Span Back- ward | Visual Search Total Score |
|---|---|---|---|---|---|---|---|---|---|
| MFFT20 Errors | | | | | | | | | |
| MFFT20 Mean latency | -.32 | | | | | | | | |
| R.C.P.M Score | -.29 | .11 | | | | | | | |
| Figure Copying Score | -.23 | .29 | .33 | | | | | | |
| Figure Copying Mean Latency | .09 | -.04 | .17 | .12 | | | | | |
| Serial Recall | -.18 | .12 | .36 | -.4 | -.22 | | | | |
| Digit Span Forward | -.33 | .13 | .04 | .09 | .23 | .44 | | | |
| Digit Span Backward | .07 | .10 | .13 | .20 | -.38 | -.02 | .38 | | |
| Visual Search Total Score | .27 | .05 | -.13 | .30 | -.06 | .20 | .19 | -.03 | |

*For P <.05 Critical = .25*

*For P <.01 Critical = .33*

**Grade- 4**

## Grade- 4

*The table -- 11 presents the Pearson's product moment intercorrelation matrix for scores on all 9 congitive problem solving measures for Grade-4 children. The degree of freedom (df) for all the variables was .58. The matrix table shows that significant negative relationship was found between MFFT20 errors and MFFT20 mean latency (r = -.32, P <.05), RCPM score (r = -.29, P <.05), Digit Span forward (r = -.33, P <.01). The MFFT20 errors has sognificant positive relation visual search total score (r = .27, P <.05). The MFFT20 errors shows a set of negative relation between Figure copying score (r = -.23), Serial recall score (r = -.18) and have positive relation between Figure copying mean latency (r = .09), Digit span backward (r = .07). The MFFT20 mean latency has a significant positive relation between Figure copying score (r = .29, P <.05) and a set of positive relation between RCPM score (r = .11), Serial Recall (r = .12), Digit Span forward (r = .13), Digit Span backward (r = .10), visual search total score ( r = .05). The MFFT20 mean latency shows negative relation ( r = .04) only between Figure copying mean latency. The RCPM score shows significant positive relation between Figure copying score (r = .33, P <.01), Serial recall (r = .36, P <.01), simple positive association between Figure copying mean latency (r = .17), Digit Span forward (r = .04), Digit Span backward (r = .13) and a significant negative relation between visual search total score (r = -.31, P <.05). The Figure copying score shows only significant negative relation between visual search (r = .30, P <.05), a general negative relation with Serial recall (r = -.04) and have positive relation between figure copying mean latency (r =.12), Digit span forward (r = .09), Digit span backward (r = .20). Figure copying mean latency shows significant negative relation between digit span backward r = -.38 p < .01 and a set of negative association between Serial recall (r = -.22), Digit span forward ( r = -.23), visual search total score ( r = -.06). Serial recall shows a significant positive relation between Digit span forward (r = .44, P <.01), a positive relation ( r = .20) with visual search total score, and a negative relation ( r = .02) between digit span backward. Digit span forward has a significant positive relation between digit span backward (r = .38 P < .01) and a general positive relation between visual search total score (r = .19). Digit span backward shows a negative relation (r = -.03) between visual search total score.*

## Table-12

## The Pearson's Product Moment Inter Correlation Matrix for the Scores on All the Cognitive Processing Variables for Grade-5 Children (n=60)

| Variables | MFFT 20 Errors | MFFT20 Mean Latency | R.C.P.M. Scrore | Figure Copying Score | Figure Copying Mean Latency | SeriaL Recall | Digit Span Forward | Digit Span Back ward | Visual Search Total Score |
|---|---|---|---|---|---|---|---|---|---|
| MFFT20 Errors | | | | | | | | | |
| MFFT20 Mean latency | -.28 | | | | | | | | |
| R.C.P.M Score | -.34 | .34 | | | | | | | |
| Figure Copying Score | -.25 | .24 | .28 | | | | | | |
| Figure Copying Mean Latency | .04 | .12 | .13 | -.22 | | | | | |
| Serial Recall | -.34 | .40 | .26 | .24 | -.28 | | | | |
| Digit Span Forward | -.31 | .28 | -.04 | .17 | -.12 | .76 | | | |
| Digit Span Backward | -.16 | -.23 | .08 | .25 | .09 | .35 | .42 | | |
| Visual Search Total Score | .30 | .10 | -.23 | -.20 | .10 | -.16 | .08 | -.36 | |

*For P <.05 Critical = .25*

*For P <.01 Critical = .33*

Grade - 5

*The table – 12 presents the Pearson's product moment intercorrelation matrix for scores on all 9 congitive problem-solving variables for Grade-5 children. The degree of freedom (df) for all the variables was .58. The significant negative relation was found between MFFT20 errors and MFFT20 mean latency (r = -.28, P <.05), RCPM score (r = -.34, P <.05), Figure copying score (r = -.25, P <.05). Serial recall (r = -.34, P <.01),Digit Span forward (r = -.31, P <.05) and a non-significant result between Digit span backward (r = -.16). The MFFT20 errors and visual search total score has significant positive relation (r = .30, P <.05) between them. The MFFT20 errors and copying latencies has a low positive ( r = .04) relation between them. The significant positive relation was found between MFFT20 mean latency and RCPM score (r = .34, P <.01), Serial recall (r = .40, P <.01), Digit span forward (r = .28, P <.05) and non-significant positive relation between figure copying score ( r = . 24), Figure copying mean latency ( r = .12), visual search ( r = .10). A non-significant negative relation established between ( r = -.23) MFFT20 mean latency and Digit span backward. The significant positive relation between RCPM score and Figure copying score (r = .28, P <.05), Serial Recall (r = .26, P <.05). A non-significant positive relation between RCPM score and and Figure copying mean latency ( r = .13) and negative relation between RCPM score and Digit Span forward (r = -.04), visual search total score ( r = -.23). A significant positive relation was Figure copying score and Digit Span backward (r = .25, P <.05). The figure copying score has a set of positive relation between serial recall ( r = .24), Digit span forward ( r = .17) and a set of negative relation between figure copying mean latency ( r = -.22), visual search total score ( r = -.20). A significant negative relation was between Figure copying mean latency and Serial recall (r = -.28, P <.05). The relation between Figure copying mean latency and digit span forward (r = -.12 ), Digit Span backward (r = -.09), visual search total score (r = -.10). The significant positive relation between Serial recall and Digit span forward (r = .76, P <.01), Digit span backward (r = .35, P <.01). It also established a negative relation between visual search (r = -.16). The digit span forward has a significant positive relation between Digit span backward (r = .42, P <.01), and with visual search total score (r = -.08). The Digit span backward has a significant negative relation between visual search (r = .35, P <.01),.*

Table-13

The Pearson's Product Moment Inter Correlation Matrix for the Scores on All the Cognitive Processing Variables for All the Children (n=60)

| Variables | MFFT20 Errors | MFFT20 Mean Latency | R.C.P.M. Scrore | Figure Copying Score | Figure Copying Mean Latency | SeriaL Recall | Digit Span Forward | Digit Span Backward | Visual Search Total Score |
|---|---|---|---|---|---|---|---|---|---|
| MFFT20 Errors | | | | | | | | | |
| MFFT20 Mean latency | -.29 | | | | | | | | |
| R.C.P.M Score | -.35 | .26 | | | | | | | |
| Figure Copying Score | -.20 | .24 | .29 | | | | | | |
| Figure Copying Mean Latency | .12 | -.37 | .05 | -.10 | | | | | |
| Serial Recall | -.19 | .09 | .24 | .14 | -.20 | | | | |
| Digit Span Forward | -.28 | .15 | -.03 | .05 | -.09 | .57 | | | |
| Digit Span Backward | -.07 | -.07 | .04 | .13 | -.17 | .22 | .39 | | |
| Visual Search Total Score | .25 | -.05 | -.22 | -.21 | .16 | -.19 | .09 | -.10 | |

*For P <.05 Critical = .19*

*For P <.01 Critical = .23*

**For All**

*The table – 13 presents the Pearson's product moment intercorrelation matrix for scores on all 9 congitive problem-solving variables for all the 180 subjects. The (df) for all the variables was 178. The matrix table shows that significant negative relation was fond between MFFT20 errors and MFFT20 mean latency (r = -.29, P <.01), RCPM score (r = -.35, P <.05), Figure copying score (r = -.20, P <.05), Serial recall (r = .19, P <.05), Digit Span forward (r = -.28, P <.01) and a low negative relation between Digit span backward (r = -.07). The MFFT20 errors has a significant positive relation between visual search total score (r = .25, P <.01), and low positive relation between figure copying latency ( r = .12 ). The MFFT 20 mean latency has significant positive relation between RCPM score ( r = .26, P < .01). Figure copying score (r = .24, P <.01) and low positive relation between Serial recall ( r = .09), Digit span forward ( r = 15), Digit span backward ( r = .06). The MFFT 20 mean latency has significant negative relation between Figure copying mean latency (r = -.37, P <.01) and low negative relation between visual search total score. The RCPM score has significant positive relation between Figure copying score (r = .29, P <.01), Serial recall (r = .24, P <.01) and significant negative relation between visual search total score (r = -.22, P <.05). The RCPM score has a low positive relation between Figure copying mean latency ( r = .05), Digit span backward ( r = .04) and low negative relation between Digit span forward ( r = .03). The Figure copying score has significant negative relation between visual search total score (r = -.21, P <.05). The Figure copying score has low positive relation between Serial recall ( r = .14), Digit Span forward ( r = -.05), Digit Span backward (r = .13), and a low negative relation between figure copying mean latency ( r = -.10), The Figure copying mean latency has a significant negative relation between Serial recall (r = -.20, P <.05) and low negative relation between Digit span forward ( r = -.09), Digit span backward (r = .17) and low positive relation with visual seach total score ( r = .16).The serial recall has significant positive relation between Digit span forward (r = .57, P <.01), Digit span backward (r = .22, P <.01), visual search (r = .19, P <.01). The digit span forward has significant positive relation between digit span backward (r = .39, P <.01), and low positive relation between visual search total score (r = .09). The digit span backward has a negative relation with visual search total score (r = .10).*

## Table – 14

## Factor Loadings and Proportions of Variance Accounted for by Different Factors and Communalities for Roated Factor Matrix

| Variables | FACTOR | | | |
|---|---|---|---|---|
| | I | S II | III | H2 |
| MFFT 20 Errors | -0.1 | -0.15 | 0.65 | 0.67 |
| MFFT20 Mean Latency | -0.64 | -0.08 | 0.07 | 0.76 |
| R.C.P.M. Score | 0.52 | -0.2 | -0.32 | 0.42 |
| Figure Copying Score | -0.38 | 0.04 | -0.48 | 0.36 |
| Serial Recall | -0.06 | 0.80 | -0.06 | 0.73 |
| Digit Span Forward | 0.13 | 0.82 | 0.06 | 0.74 |
| Digit Span Backward | 0.04 | 0.39 | -0.12 | 0.5 |
| Visual Search Total Score | 0.14 | 0.13 | 0.67 | 0.49 |
| *Proportion Variance* | *26.3* | | *18.42* | *9.68* |

***Note*** *: $\pm \geq .30$ had been considered to be Significant loading.*

## Correlational and Factor Analysis

*Pearson's product moment correlation co-efficient were computed for scores on different variable across different grades. The intercorrelation matrix for Grade-3, Grade-4 and Grade-5 children were presented in Table – 10, 11 & 12 respectively. These correlation matrixes revealed a similar pattern of relationship noticed among the variables across different grades. This similarity in the trend of correlational analyses lead to combine the data for all the grades and compute one inter-correlation matrix for all the 180 children. The intercorrelation matrix for all the 180 children are presented in Table-13. The examination of the above intercorrelation matrix table reveled that RCPM score, Figure copying, MFFT 20 Errors, and MFFT 20 mean latency, visual search total score, were significantly intercorelated. On the other hand scores on serial recall, digit span forward, digit span backward were significantly intercorrelated. Therefore, intercorrelataion matrixes were subjected to principal component analysis.*

*Then factor-analysis was conducted to know the principal component those who were functioning undelying the 9 cognitive variables. The resulting factor matrix was subjected to varimax rotation. The Eigen values were calculated for all the variables and Eigen values above 1 were included in the factor rotation. Following the scree test criterion (Cattell, 1966) 3 factors were obtained under the varimax rotation and loading of $\pm$ > .30 considered to be significant factor loading. The three factor in the combination were found to account for the back of 54.40 % of variance in common.*

### Factor I (Basic Reasioning Process)

*The factor I was identified as the basic reasing process which accounted for highest percentage of variance (26.3%) among the three factors. It was found that Factor I had high loading on MFFT 20 Mean Latency (-.64), RCPM Score (.52), Figure copying score (-.38), Figure copying mean latency (.62). This factor has close*

*resemblance with simultaneous information processing (Das et al, 1979). The factor basically tapped general basic reasoning ability, which is responsible for approaching and solving any problem task.*

**Factor II (Memory Process)**

*The factor II had been indentified as memory process, which accounted for the 2nd highest percentage of variance (18.42%) in common among the three factors. This factor had high loadings on serial Recall Task (.80), Digit Span forward (.82). This factor also had significant loading on digit span Backward (.39). The factor resembled the successive information processing of Das et el. (1979). The factor is rightly named as the memory process which is responsible for fast and accurate coding.*

**Facto III (Motivational Process)**

*The Factor III had been identified as Motivational Process. This factor had accounted for third highest percentage of variance (9.68%) in common among the 3 factors. This had high loading on MFFT 20 errors (.65), Visual Search total score (.67) and significant loading on RCPM score (-.32) and Figure copying score (-.48). This factor resembles the selective attentional process.*

# CHAPTER - IV
# DISCUSSION

## Reading Achievement and it's Relation to Other Processing Variables

### Cognitive Measures :

*The present findings revealed that high reading achievers and low-reading achievers differed significantly on the MFFT task. While the mean latency for the two groups was similar the low reading achievers committed more errors on MFFT task compared to the high reading achievers. The findings implied that the low reading achievers tended to be more impulsive and as such they fail to utilize reflective strategies. On the contrary high reading achievers are well and efficient enough in utilizing the reflective processing strategies. The high reading achievers discovered the right solution hypothesis in MFFT problem-solving situation which contained high response uncertainty due to high degree of similarity among the solution hypotheses. As a result the high reading achievers utilised superior evaluation strategies known as reflective processing compared to their low reading achieving counterparts who followed more impulsive processing; the inferior processing strategies. The present finding supported the findings reported by Block, Gjerde, and Block (1986) who reported that the error component in the MFFT is the most vital in discriminating individuals or groups which is contrary to the position advocated by Kagam and Messer (1975) ; and Kagam (1987) who viewed that a combination of the errors and latencies determine the quality of performance. Block (1987) propounded that the error and latency combined score will not contribute better than the error component used alone and the correlates generated will have little connection with the concept of reflection-impulsivity, which Kagan initially defined decision-speed in the MFFT situation. The above interpretation strengthen the present study due to non-significant difference between high reading achievers and low reading achievers on MFFT latency and speed measures.*

*In RCPM scores the high reading achievers and low reading achievers did not differ significantly. They show a comparable performance in RCPM scores as a measure of Intelligence or I,Q, Reading achievement may be believed to be a function*

*(Torgesen, 1988), because many sub-skills involved in reading such as vocabulary, comprehension, are used in intelligence test (Siegel, 1989). Positive correlation between reading ability and intelligence raising from 0.3 to 0.7 have been reported (Stanovich, cunnigham & freeman, 1984). The correlation between I.Q. and reading increases with age. Younger children emphasize the decoding of print where as older children put their emphasis on comprehension. That is why correlation between I.Q. and reading reported to be lower in elementary grade subjects compared to adult subjects.*

*In Aron's (1985) study of dyslexic college students, neither reading speed i.e., decoding nor reading comprehension was found to have significant positive correlation with general intelligence indexed By I.Q. Scores obtained from the WISC-R. This confusing result lead Aron to hypothesize that reading disabled children have difficulty in applying rules for grapheme-phoneme conversion. Decoding and reading comprehension are two independent skills. In dyslexia, this autonomous specific ability namely the decoding skill which is independent of general intelligence may be operating as a limiting factor affecting reading comprehension.*

*Contradictory evidence regarding positive correction between intelligence and reading ability comes from the very definition of specific reading disability. In this context, Rutter and Yule (1975) talked of general reading backwardness and specific reading retardation. If a child's reading achievement is substantially below the level that is expected for his age then he is said to have reading backwardness. On the other hand, reading retardation is a condition where reading achievement is substantially below the expectation for age and I.Q. To put in a similar way, these two disorders can be distinguished in terms of I.Q. Where as the backward readers have below average I.Q. the retarded readers are intellectually normal. Stanovich (1988) recognised phonological coding rather than I.Q. as a better predictor of reading ability.*

*The finding of the present study revealed that the high reading achiever out performed their low reading achiever counterparts on simultaneous processing*

*measures such as figure copying as well as in successive processing task such as Serial recall, digit span forward and digit span backward. This finding replicated the result reported by Rath, Mohapatra, and Mishra(1987). On a group of disadvantaged children Das and Das (1984) administered the simultaneous and successive tasks and reported that the disadvantaged children had inferior performance compared to their advantaged counterparts. For clarity and better understating regarding reading achievement of high reading achievers compared to low reading achievers, several experimental findings and theoretical constructs have greater importance to be maintained.*

*Different reading psychologists have speculated several causes for reading failure. Their views are diverse and range from brain dysfunction to inadequate linguistic processing, from perceptual deficiency to inappropriate information processing. The PASS (Planning-Attention-Simultaneous-Successive) model is a modification of the information integration model earlier advanced by Das, Kirby and Jarman (1975, 1979). Being the basis of the information integration model, Luria's neuropsychological model provides clear neuropsychological explanations of cognitive functions.*

*Luria's (1966, 1973, 1980) marked that individual's with frontotemporal lesions have difficulties in successively automated and organised speech. Difficulty in evaluating the correctness of grammatical structure is also found with such individuals. Patients with lesion in the Parieto-occipital sections of the speech area unable to comprehend some kind of logical grammatical constructions sentences involving comprehension's, such as , "ltaller than", or special prepositional constructions, such as, "above", "below" or "inside" are difficult to be comprehend. From these findings, Luria concluded that successive processing underlines the understanding and production of contextual grammatical structures, and simultaneous processing involves processing of the other aspects of grammatical structure; i.e. "the communication of relationship". In fact, the importance successive processing for the*

*contextual grammatical aspects of language and simultaneous processing for the logical grammatical aspects of language have been studied by Das, Cumins, Kirby and Jarman (1979), Das, Kirby and Jarman (1979) and Luria (1966, 1980).*

*These finding may be helpful for understanding reading ability. The relationship between processing and reading may be studied either by observing information processing correlates of various skills or by comparing groups differing in reading skill. Successive processing was found to be correlated with word decoding in several studies (Cumins & Das, 19977, 1978; Kirby & Robinson, 1987; Krywaniuk & Das, 1976). Simultaneous processing was found to be significantly related to the drawing of inferences, and integration of phrase-level units (Kirby & Gordon, 1988). Kirby and Das (1977) found both simultaneous and successive processing to be related with various achievement measures. Similarly, Naglieri and Das (1987) also obtaines correlation between planning, simultaneous, and successive scores and various achievement measures. From these correlational research findings, it seems that the lower level skill of phonic decoding dependes on successive processing, where as comprehension skills depend more on simultaneous processing.*

*The second group of studies compare the information processing skills or groups who differ in overall reading ability. By this approach also, poor successive coding is linked to reading acquisition (Bisanz, Das & Mancini, 1984; Das, 1985, Das & Siu, 1989; Kirby & Robinson, 1987; Leong, 1980; Snart, Das & Mensik, 1988). These levels are letter features, letters, letter groupings or syllables, words, syntactic phrases and main ideas or micropropositions. Simultaneous and successive processes operate within and between these levels (Kirby, 1986, 1988; Kirby & Das, 1990; Kirby & Williams, 1991). At each level, a set of units are held in an arbitrary (successive coding) so that a higher level code can be used to re-code or chunk the set as a single unit (simultaneous) for the next higher level of analysis. In skilled reading, the lower levels must be operating automatically so that attention can be devoted to the higher levels.*

*On the visual search total score, there was a significant difference between the scores of high reading achievers and low reading achievers. The high reading achiever take less time in the course of performance on visual search total score. In comparison the low reading achievers take more time in the course of performance. The result reveals the high reading achievers established their superiority on a planning measure. Visual search measures planning at the perceptual level. Planning has been found to be related to reading achievement by several researchers (Ashman & Das, 1980; Das & Heemsbergen, 1983, Garefalo, 1986). Planning correlates significantly with reading decoding and reading comprehension with elementary grade students (Das, 1984; Leong, Cheng, & Das, 1985). Neglieri and Das (1987) studied grade 2,5 and 10 students. Planning was found to be become increasing correlated with achievement with increasing grade.*

*Reading involves a hierachy of several levels of analysis like letter, features, letters, syllables etc. Skilled reading requires automatic operation of the lower level analysis so that attention can be devoted to the higher levels. Planning is required to keep the reader's attention on the level at which the current task is focused. In reading comprehension tasks, planning may be required for a thoughtful consideration of all the critical information, hypotheses making, and strategy invention.*

*The analysis of the literature provides the evidence that reading is a complex mental process requiring several process . The linguistic theorists viewed reading as a complex linguistic activity involving several linguistic processes such as verbal processing, phonological processing , semantic and syntactic processing and metalinguistic processes such as reading awareness. Linguistic theorists like Vellutino also strong argue that reading failure is the result of deficit in verbal processing. But information processing theorists provide an information processing model in order to explain the reading process. Das and his colleagues have proved the dependence of the reading process on the component processes of the PASS (Planning, Attention, Simultaneous, and Successive) model theoretically as well as empirically. It has been*

*shown that the simplest form of reading i.e. decoding dependes on successive processing. Reading comprehension involves both the successive and simultaneous processing of information. At different developmental levels, reading relies differently on the different processes. Moreover, skilled and less-skilled readers also approach the task differently. However, it seems more plausible that there is hierarchical involvement of both the simultaneous and successive processing in reading. Without planning there would not be any efficient application of the reading processes and as a result reading would not be successful.*

**Behavioural Measures:**

*On the classroom behavioural measures (i.e., SCRS; 33 items & SCRS; 7 items) the classroom teachers rating revealed that no significant difference was established between the high reading achievers and low reading achievers. The high reading achievers are not better rated compared to the low reading achievers. So the main effect on reading achievement of high reading achievers are at par with low reading achievers on behaviour ratings. In the SCRS, 7 items also no significant difference was found between these two broad groups. It may be the fact that all the subjects are born, brought up and enjoy same environment, as well as Socio-Economic and demographic factors which had a great impact on the external behaviour of the subjects. So the classroom teachers did not find any difference on their rating scores of behavioural measure.*

**Achievement Measures :**

*With regard to the classroom achievement measures the high reading achievers were found superior compared to the low reading achievers on all the five achievement measures. The high reading achievers established their superiority as the name of the group indicates. In support of this finding much information was presented in earlier discussion on cognitive measures. Here some theoretical information to be worth mentioned, by taking a short diversion from the theory of PASS (Planning, Attention, Simultaneous, and Successive) model.*

*In M.I.L. (O) the low reading achievers had inferior performance compared to the high reading achievers. As it is evident from different studies that proficiency in language paper depends on effective linguistic coding. Vellutino and Scalon (1985) reported a significant deficiency in linguistic coding of the poor readers. Taking poor and normal readers from grade-2 and grade-6 subjects, they compared the recall score of concrete and abstract words. The poor readers at both the grade levels performed lower than their normal counterparts on recall of concrete as well as abstract words. Thus deficiency in verbal proficiency is suggested to be an important factor contributing for language studies in M.I.L. (O). Metalinguistic awareness is believed to the most important factors contributing to the low reading achievement of subjects (Pani 1988, 1991). As metalingustic awarness includes all the reflection, ideas, knowledge of underlying principles, rules etc. concerning language structure, functions and rules governing its use. As language served as the medium of instruction and also expression, the low reading achievers face a great deal of problem while adjusting to the school curriculum prescribed for them especially in M.I.L. (O) and social studies.*

*From the school attendance register it is observed that low reading achievers have less percentage of attendance compared to the high reading achievers. For which they lack more information that are taught in their respective schools. So for which they might have secured poor marks in all subjects compared to high reading achievers. The low reading achievers lack confidence in answering questions, they might thought or errors, which results in punishment by the teacher. Due to fear, they lack answering the appropriate information in appropriate place. While answering questions on arithmetic and general science it might be the happening on the part of low reading achievers. It is generally observed that teachers have much attention to students whose achievement score are high and above average. Teachers use verbal praising as well as sound emotional softness towards these students. By the way the low achieving students face emotional adjustment problem with school environment.*

*As mathematical ability is a major contributing factor in arithmetic reasoning. So also the low reading achievers might have that short of ability deficiency in answering arithmetic achievement-tasks. Lastly motivation as an important factor that can not be ignored. When and where motivation lacks, the achievement score definitely drops down. So also the achievement of poor marks on the part of low reading achievers. The low reading achievers score on drawing also might be the result of low motivation in drawing simple figures as those are generally asked to draw in primary schools for drawing achievement tests.*

## R-I Information Processing and Developmental Trend in MFFT

*The data of the present study indicated that the reflective children performed better than their impulsive counterparts in MFFT20. The findings also revealed an inverse relationships between errors and latencies confirmed that children who responded slowly tended to be more accurate than those children who respond quickly. Children of the lower grade committed higher mean errors, where as , the higher grade children committed less mean errors. With regard to the latencies, the children of lower grade took less time to respond to MFFT20 in comparison to the higher grade children. The present findings supported the earlier conclusions which typically showed that children become more reflectives as they mature with increased age. As the children grow older, they become less impulsives and become more reflectives. As a result, the children of the higher age group commit less errors and take more time to respond to MFFT. This findings lend support to cross-sectional and longitudianl studies conducted by Salkind and Nelson (1980); Cohen, Schleser and Mayers (1981), Paulson and Johnson (1980). In addition, the negative correlation between response time and errors tends to become larger and larger with increased age. This inverse relationship between errors and latencies, however, have been found to be less robust and less consistent in pre-school children. The median correlation for samples of subjects of 5 years or younger has been found to be -.28 as reported by Messer (1976) and Schacht (1983), and Block et al. (1986); where as for school aged children it is*

*found to be around -.56. Delay in response time is a developmental phenomenon, which has been well documented in the developmental literature. Hence delay in latency is associated with fewer errors seem to emerge and gets strengthened after school entrance. It is suggested that in early years children do not realise that delay is an use full strategy on solving complex-problems. As a result they do not activate the strategies of delay (Messer, 1976; Rath, 1983). Ward (1973) reported that the young children or the pre-schoolers are more oriented to the tester or the experimenter, rather than to the test items. Others suggested that young children do not possess a strong motivation for performing well on complex problem solving task such as MFFT (Peters & Bernfeld, 1983). Salkind and Nelson (1980) reported a developmental progression from impulsive towards increasing reflectivity up to 10 years of age, after which stability in error rate and decrement in latency were marked. For 9 and 10 year old children, the response time and error correlation is highest (-.57, -.58 respectively) but for 5 and 6 year old children, the correlation is lower (-.41 and -.45 respectively). While interpreting these correlation one must be aware of the floor and celling effects as that MFFT tasks may be very difficult for younger children but may be easier for older children.*

## R-I Information Processing and its Relation to other Processing Variables

### Cognitive :

*Children who followed reflective information processing were found to be better in RCPM score, Figure copying score, and figure copying mean latency score, than the impulsive children. These three cognitive measures comes under the simultaneous processing. This might be due to the systematic evaluation, competence and integration of incoming information by the reflective children. The research findings indicated by Merritt, Frank McCallum (1984) supported the findings which viewed that the children with good reflective and analysis processing strategies have the systematic approach towards various complex tasks. As the child's orientations towards a task involve a purposive and deliberate intention to understand and master*

*the material; his/her performance is likely to be more accurate (Rath, Mohapatra, & Mishra, 1987; Kurl & Borkowski, 1987; Nicholls, Patashnik, & Nolen, 1985). In connection with the latency score of the figure copying task the similar trend as MFFT was revealed which indicated that the reflectives took more time to complete the drawing of geometrical figures than the impulsive children. It was due to the information processing strategies about the detail search of stimulus items and achievement norms developed by reflective children, and so they were involved in the task for a longer period (Blumenfeld, Pintrich, & Hamilton, 1987; Rath, 1987).*

*The data derived from successive processing measures revealed that reflectives performed better than the impulsives on the Digit span forward. In Serial recall and digit span backward no significant difference between reflectives and impulsives was found. There is also insignificant result in case of reflectives and impulsives on the planning task of visual search total score. The impulsive processors by nature are less motivated. Hallahan (1980) found that impulsives showed more attention shifts and off task behaviour than reflectives. In information processing lower level skill of phonic decoding depends upon successive processing for which short-term memory is responsible. As impulsives are less motivated so they might have not exercise their short term memory for answering the Digit span forward in the course of test administration. So for which they might secure a l ow mean score on Digit span forward compared to the reflectives.*

**Teacher Rating of Classroom Behaviour Measures:**

*The present study established the difference between reflective and impulsive children on cognitive self-control measures as rated by class teachers. In self-control rating scale the scores were higher for impulsives suggesting less self-controlled compared to their reflective counterparts. As a result the present study supported the findings of Kendall and Wilcox (1979), Kendall and Zupan (1981), who reported significant relationship between SCRS and MFFT20 scores. Although, Kendall et al. have never reported the scores of reflective and impulsive children on SCRS, they did*

*report that children who were referred by their teachers for behaviour problems more significantly differentiated from the non-referred children on self-control ratings. They also strongly view that SCRS is sensitive to differences in R-I dimension as measured by MFFT. Thus, the present findings were consistent with the prediction of Kendall and Wilcox (1979); Kendal and Zupan (1981). Also the class teacher could differentiate the reflective and impulsive children in their motivational level in the classroom situation. The reflectives were found to be more motivated to do well in the classroom task compared to their impulsive counterparts. This finding is consistent with findings reported by Kagan (1987). The findings suggest that the cognitive information processing as tapped by MFFT and observable behaviours as measured by SCRS in the classroom are quite related. The motivation ratings of teacher provide evidence that impulsives seem to be less concerned, less persistent, less careful and shown inadequate motivation on cognitive tasks. The findings replicated the work of Bernfeld (1982); Loper and Hallahan (1980), who have argued that in general impulsive children are comparatively less motivated and less concerned to perform well on cognitive tasks. This appears to be that impulsive children show, initial production deficiencies in motivation, attention and cognitive effort.*

**Achievement Measures :**

*The data of the present study obtained on the various academic achievement demonstrated that there were significant differences in all area of chievement between reflective and impulsive processors. The reflectives performed significantly better in the area of M.I.L.(O), Arithmetic, General Science, Social Studies and drawing in comparision to their impulsive counterparts. The findings indicated that the reflective processing is very much helpful in achieving academic success in the classroom. This findings is consistent with the finding reported by Messer and Schacht (1983) which revealed that reflective MFFT performance is related to various academic tasks. Rath (1990) showed that reflective children performed better in Arithmetic, General Science and Social studies achievements compared to their impulsive ounterparts even after*

*the IQ factor has been partialled out or controlled. Egeland, Bielke and Kendall (1980) reported simailar findings in case of second, fifth grade and Kindergarten children. On the other hand , the present findings did not support the result reported by Bentler and McClain (1976) who found no differnece between reflective and impulsive children in a sample of grade five children. Bentler and McClain in their study used the double medium split procedure in classifying subjects into reflectives and impulsives. This procedure has been seriously criticised from statistical and conceptual grounds as reported By Block et al. (1974, 1986). In the present study, the classification errors have been rectified by following a continuous impulsivity-efficiency criteria (Refer method section for details).*

*The impulsive processors have been shown to be better in estimating, guessing, spontaneous productions and artistic achievement (Zelniker & Jeffery, 1979). But these children by nature less motivated and therefore, do not mobilize more effort to do well in traditional classroom tasks such as Science, Arithmetic, Social studies etc. (Kagan, 1987). In a carefully designed classroom observational study on 10 years old sample Loper and Hallahan (1980) found that impulsives showed more attention shifts and off task behaviour than reflectives. Impulsives have a tendency to process less effortfully or more compressionstically (Smith & Nelson, 1987). But this does not mean impulsives are less capable but they are less motivated and dot not exercise their brain spontaneousely unless forced or compelled to do so. This findings support the motivational and effortless-effortful dynamics proposed by Rath (1987). The correlational findings indicated that it was the MFFT error and not the latency measures which were highly related to achievement measures. The data revealed that the children who committed less errors on MFFT on MFFT test are better academic achievers. The EFFT latencies had lower magnitude of positive correlation with achievements measures. The error component in MFFT variable had been found to be more important rather than the amount of time, the child spends reflecting over his or her hypothesis. This finding is contrary to Kagan's (1987) conceptualisations that*

*cognitive tempo is more a decision time variable rather than the decision error variable. Then present findings is in agreement with the findings of Block et al. (1980, 1986); Smith and Caplan (1988) who reported that MFFT error measure had greater predictive power compared to the latency measure.*

**Grade Difference and Developemtn Trend :**

*In the present study chidren from three different grades (Grade-3, 105 months age; Grade-4, 117 months age; and Grade-5, 130 months age) were incllluded in order to examine the grade differences and development trend in different cognitive processing tasks. The design followed in the study was a typical cross-sectional design. Though there are several short-comings in a typical cross-sectional design the data revealed many interesting trends attributed to age changes. In case of MFFT performance significant grade difference were obtained which indicated that children typically become more and reflective with increase in age. There was significant decrease in error rate and increased latencies when three different grades were examined. Following cross-sectional and longitudinal studies Messer and Brodzinsky (1981), Slkind and Nelson (1980) had shown that error rate in MFFT gradually decline over time till the child attends the age 10, there after it remains relatively stable. On the contrary, the latency rate decreases overtime at a rapid rate till age 10 and thereafter the decrease in latencies continues but at a very slow rate. The constant inverse relationship between errors and latencies in case of MFFT demonstrates the fact that the children who take less time invariably commit more errors and known as impulsives. Where as, the children who take more time commit less errors are known as reflectives. As the child grows older, his/her search strategies becomes more complex refind and sophisticated and goal oriented as a result he/she delays response and commit less errors on complex problem-solving situation, where response uncertainity is very high. Across three cultures Smith and Caplan (1988) had shown that error rates decrease more rapidly than the typical increase in latency rate with increase in age. Japanese children were found to be dissect from other cultures in the*

*developement of reflective information processing as measured by MFFT. Compared to children in other culture, Japanese children become far more accurate or commit less errors on the MFFT with small increase in latencies over years.*

**Cognitive Measures and Behaviour Measure :**

*A significant grade differences had been observed for simultaneous and successive processing measures. A continuos improvement in performance across grades were revealed from Grade-3 to Grade-4 and from the Grade-4 to Grade-5 in tasks like RCPM, Figure copying (Scores and mean latency), and Serial recall. The present findings can be reported in the light of the interpretation reported by Das (1984). From his studies it can be revealed that simultaneous-successive processing seemed to increase as a function of age and educational experience. As the children grew older and moved to the higher grades simultaneous successive processing strategies were progressively more evident and differentiated as function of age and schooling experience. The non-significant results were obtained on DIgit Span (forward and backward) scores among higher and lower grades. Das (1988) reported that memory span for digit shifted from 3.6 to 4.8 digits between 6 to 11 years. Hence it was natural that non-significant results were obtained when 8 to 11 years old children included in the presnet study and were compared in thier digit span scores. A non-significant result on grade difference was obtained for visual search total score. Planning being a higher level construct, shows a positive correlation with achievement in an increasing grade difference. Here planning shows a non-significant result with grade. Visual search measures planning at the perceptual level and time basically is the measurement yardstick. So while responding to a visual search test, the subject develop a sense of altertness to time factor (Detecting the required figure from the complex figure structure). It might be case with subjects responding from different grades. So the senses of altertness leads to an insignificant result incase of grade difference. The non-significant result for Behavioural measures of SCRS : 33 items*

*and SCRS:7 items was obtained. So grade main effect collapse while measuring the subjects behavioural and motivational aspects.*

**Achievement Measures :**

*In case of classroom achievement significant grade differences had been obtained in all achievement measures, taken for this research. The percentage of marks secured by children in different grades showed a correspondingly decline trend. A reverse trend was noticed on drawing score. The grade – 3 children secured less marks compared to Grade – 4, and Grade – 4 compared to Grade –5. From the result table it was observed that Grade –3 children secured 50.27%, 52.90%, 52.13%, 49.93%, 36.97%, the grade 4 children secured, 41.07%, 43.36%, 43.08%, 42.68%, 40.68%, and grade –5 children secured 38.36%, 36.53%, 36.23%, 38.65%, 46.95% in M.I.L. (O), Arithmetic, General science, Social studies and Drawings achievement respectively. The gradual decline in percentage of marks over grade revealed the fact that the curriculums become gradully more difficult, and extensive. More sense of reasoning, as well as language competence is reuired in higher grades. As a result in spite of cognitive maturity with increased age, children secured less percentage of marks in higher grades compared to their lower grades. For drawing achievement the Grade –3 children have lower score compared to grade –4, and grade –4 to grade –5. For drawing had steadiness and perceptual accuracy both have great importance. As age difference ws significant, so the steadiness in had might be lacking with Grade –3 children compared to Grade –4, Grade –4 to Grade –5.*

**Correlation and Factor Analyses :**

*Pearson's Product moment correlation co-efficients were computed for scores on different variables across different grades. The inter-correlation matrix for Grade – 3, Grade –4, and Grade –5 children were presented in Table – 12, 13 & 14 respectively. These correlation matrixes revealed a similar pattern of relationship noticed among the variables across different grades. This similarity in the trend of correlational analysis leads to combine the data, for all the greades and compute one*

*inter-correlation matrix for all the 180 children. The inter correlation matrix for all the 180 children are presented in Table – 15. The examiniation of the above intercorrelation matrix table revealed that RCPM score, Figure copying score, MFFT 20 errors, and MFFT20 mean latency, visual search total score, were significantly inter-correlated. On the other hand scores on Serial recall, Digit span forward, Digit span backward were significantly uncorrelated. Therefore, intercorrelation matrixes were subjected to principal component analysis.*

*Then Factor analysis was conducted to know the principal components. those who were functioning underlying the 9 cognitive variables. The resulting factors matrix was subjected to varimax rotation. The Eigen value were calculated for all the variables and Eigen values above I were included in the factor rotation. Following the scree test criterion (Cattell, 1966) 3 factors were obtained under the varimax rotation and loading of ± ≥.30 considered to be significant factor loading. The three factor in the combination were found to account for the bulk of 54.40% of variance in common.*

**Factor I (Basic Reasoning Process) :**

*The Factor I was identified as the basic reasoning process which accounted for highest percentage of variance (26.3%) among the three factors. It was found that Factor I had high loading on MFFT20 mean latency, RCPM scores, Figure copying score, and figure copying mean latency. This factor has close resemblance with simultaneous processing (Das et al. 1979). This factor basically typed General basic reasoning ability which is responsible for approaching and solving any problem task. Simultaneous processing constitutes the lagico grammatical aspect of language which develops as a function of maturation and reading status. This is evident in the present study of from the significant main effect of grade and reading achievement.*

**Factor – II (Memory Process) :**

*The Factor II had been identified as memory processes which accounted for the second highest percentage of variance (18.42%) in common among the three factors.*

*This factor had high loading on Serial Recall, Digit span forward. This factor had also significant loading on Digit span backward. The factor resembled the successive processing of Das et al . (1979). This factor is responsible for understanding and contextual grammatical aspect of language. Successive processing tasks are basically memory tasks and memory capacity is strongly related to the reading achievement, (Jorm, 1983). For high-level processing in reading greater working memory capacity is required. As successive processing is responsible for fast and accurate coding and recoding of letters to words in the working memory. So this factor can be rightly named as memory process which has a close resemblance with successive processing of Das et al. (1979). For successful performance in any problem solving task requires cues and past information from the memory or existing repertoire. The children must utilize their past experience and retrieve kind of information from the memory store for successful and finding out solution to difficult problem – solving situations.*

**Factor – III (Motivational Process) :**

*The Factor – III had been identified as motivational process. This factor had accounted for third highest percentage of variance (9.68%) in common among the 3 factors. This factor had high loading on MFFT20 errors, Visual search total score and significant loading on RCPM score and Figure copying score. This factor resembles the selective attentional process. This factor is found to be important one in cognitive dimension which contributes a great deal in terms of motivation/interest for successful performance in a complex problem solving situation. A child might have good memory, high reasoning ability, capability of exercising more effort and high intelligence, but if he/she is not likely to be extrinsically motivated to do well, the performance is likely to be much inferior compared to his/her counter parts who possesses a high sense of motivation for that particular task. The present study supported this factor. The impulsive children who were found to be at par with the reflective children on general ability could not do well on varieties of problem – solving tasks due to lack of proper interest and motivation. Since they were less*

*motivated, they did not optimally employ cognitive effort in order to show comparable performance with their reflective counterparts on varieties of cognitive tasks used in this piece of research. Rath (1983) viewed that when impulsive children were given verbal self-instrumental training programme in order to arouse greater motivation in them, their performance could be shown to be as good as their reflective counterparts.*

## Conclusions and Implications

*The findings of the present study highlight the following conclusions and implications. One of the major significant findings of the present study is that high reading achievers have done well in some cognitive problem solving tasks. However, the reading disabled children were found to be inferior in simultaneous and successive processing tasks. The present performances of low reading achievers may be attributed to deficiency on memorization process. In fact, poor memorization of low reading achievers may be accounted for by their slower naming speed and speech rate (Acreman, Dykman; Gardner, 1990; Das, 1985; Das and Siu, 1989). This poor coding speed may be providing limited space for memory to be accomodated. The low reading achievers have deficits in coding, naming and memory, that are responsible for reduced attention available for comprehension.*

*The low reading achievers have poor memory, short term memory or working memory (Das & Siu, 1989; Healy, 1977 ; Katz, Healy & Shankweiler, 1983; Swanson, Cochran & Ewers (1990), Torgesen & Houck (1980). The low level achievers are inferior to average children across working memory (Swanson, 1994). For reading failure the less development of decoding and spelling skills have greater importance in comparison to contextual cues and meaning based strategy.*

*The success rate of these low reading achievers in academic sphere is very low. The Low Reading Achievers in comparison to their High Reading Achievers counterpart face tremendous difficulty in adjusting to their classroom situations and suffer from servere emotional and behavioural problems including attention deficit disorders. Evidence regarding the attention deficit in the learning and reading disabled children are many in the literature (Cantwell and Baker, 1991; Hallahan et al., 1978). The critical sympotom of low reading achievers is his proneness to 88 distraction by irrelevant stimuli in learning situation. There is disinhibition of orienting response. These children may be described as hyperactive children having a*

*high level of arousal. They lack the efficientscreening system by which only relevant stimuli arouse the orienting response of the normal subject. Due to their high arousal level and absence of efficient screening system, the low reading achievers might have preferred less accurately without any effect to their speed.*

*For any complex cognitive task, information has to be registered first before being processed. Registration invloves sensory perception and communication to appropriate areas where it will be further analysed. Since all the incoming information at any given moment can not be registered, the child has to be selective. Registration of information is a directonal process involving active search and thinking. This may be conceptualized as selective attention and this is not optimum, processing of information will obviously be hampered leading to cognitive deficiencies.*

*Moreover, planning plays a substantial rôle in high cognitive problem solving task. Planning is necessary for apprppriate employment of simultaneous and successive processes of coding, (Cumins & Das, 1977). Low reading achievers might have using simultaneous processing inappropriately in case of successive processing and successive processing instead of a appropriate simultaneous processing, there by exhibiting a deficiency in planning process.*

*In consonance with Luria's (1980) it may be argured that the frontal lobe which is the last acquistion of the evolutionary process, is the sit of planning. The frontal lobe structure become mature only during $4^{th}$ and $5^{th}$ years of life. When the child take the conscious control of behaviour. Thus by age 5, the child should perform simple planning task. As the subjects in the present study have passed this stage of development, the low reading achievers and high reading achievers have a comparable performance in simple planning task. Higher level of planning develops later on for complex cognitive problem solving. Complex cognitive problem solving needs more abstract and analytic approach to one's thinking process. This is actually known as conceptual learning, which exactly differentiate between low reading*

*achievers and high reading achievers. The low reading achievers and high reading achievers do not differ so much on perceptual planning task, but differ in conceptual planning task. As the cognitive problem solving tasks needs conceptual planning rather than perceputal planning. In conceptual learning high reading achievers done well in comparison to the low reading achievers.*

*The inverse relationship between speed and accuracy, incase of young children has been found to be a stable index across different cultures and also an important predictor of performance. Children who respond slowly tend to be more accurate in complex problem solving situation, than those children who respond hastily and quickly. The data also reveal that the delay in response time nurtures reflective thinking and a very useful strategy for successful performance in problem solving task. This delay has been found to be a development phenomenon. As children grow and mature they gradually realise the importance of delay phenomenon as a result older children successfully utilise delay strategy compared to their younger counter parts. Delay in latency is invariably associated with fewer errors and seem to be universal phenomenon. The ninverse relationship between speed and accuracy emerges and get strengthened after school entrance. Children in lower age group generally are found to be more impulsive information processors, where as the children of the higher age groups are seem to be more reflective processors, who successfully utilise the delay mechanism. Although reflective information processing compared to impulsive information processing has been found to be a superior strategy in problem solving tasks such as simultaneous processing, successive processing, planning and general reasoning task, the same superiority could not be established in may other complex problem solving situations such as successive processing. These findings therefore highlight the fact that it is wrong to assume the children how follow impulsive information processing are less intelligent or incapable of effortful processing in difficult problem solving task as proposed by many authors. Rather the distinguishing variable may be that the amount of active cognitive energy and control being*

*mobilised by impulsives has sometimes inadequate and suboptimal. In order to meet the task demands impulsives engage in passive exploration, which comprises a rapid, automatic responses guided by stimulus salience rather than active search behaviour which is deliberate goal directed, and guided by relevance. The findings highlight that cognitively impulsive processors seem to suffer from a high degree of production or performance deficiency rather than deficit in ability or skill. The problem for those children is of accessibility and optional implementation of the skill and knowledge that they posses. It reasonable to argue that these children demonstrate inability to employ greater effort spontaneously, do not exercise details scrutiny, less motivated and less task concern, and do not mobilise spontaneous cognitive self control on their plans, though evaluations and actions. This interpretation is strengthened by the data provided by the classroom teachers who reported that impulsive children have less self-control, less motivated, inattentive, passive, less task concern and less persistent in their effort in classroom assignments and in cognitive tasks. The present data lead support to the motivational and effortful dynamic model in cognitive impulsivity proposed by Rath (1987), Pani (1991). The study has direct implications for remedial educational programmes for impulsive groups of children who constitute a bulk of significant school population (estimated about 30% of the total school population at primary level.). Studies conducted by Peters; Heusser (1981), Rath (1983), Pani (1991) have revealed that the impulsive children show dramatic improvements on their performance level in may cognitive problem solving tasks, when remedial training programmes have incorporated motivational components. It has been shown that when the value or salience of wrong responses is increased particularly through material loss and negative feed back through response cost and other operant procedure, the impulsive children show comparable performance with that of reflective counterpart.*

*The present study further revealed that as the children grow older and move to the higher grades, the attentional awareness, planning, simultaneous and successive processing, reflective and impulsive information processing seems to under go*

*qualitatives changes as a function of age. (Intellectual and physical development and educational experience). Many congnitive tasks those have been selected for the study are related to the attentional awareness, planning, simultaneous and successive abilities of the subjects. These abilities are higher order construct, which develop at later stage. For example, planning involves perceptual , mnestic and conceptual level. All these tasks chosen are developmentally sensitive. In other words, both the low reading achievers and high reading achievers improved their ability to plan, to select and use a strategy at perceptual , mnestic as well as conceptual level with increasing age and grade. Naglieri and Das (1987) have previously reported the developmental increment in planning tasks. Moreover planning is also necessary in appropriate employment of simultaneous and successive processes of coding and this ability grows effectively with increase in age and grade (Cumins & Das, 1977). In spite of qualitative change in cognitive strategies with increasing age, how ever in case of achievement of measures, there was a gradual decline in percentage of marks over grades. This may be due to varied and difficult curriculum prescribed in the higher grades. Inspite of cognitive maturity, with increased age the children seem to secure less percentage of marks in the higher grades compared to the lower grades.*

## Direction for Future Research

*The current study has revealed serval interesting result, more research questions have been unfolded which needs to be addressed in the future research. Performance on the information processing tasks has been considered to be a function of reading ability. The teachig learning conditions prevalent in school induce specific habitual patterns of information processing. The present study have little such information. For example, children are taught in a situation where rote learning has given much importance, where successive processing may be more rapid. The curricular programme of schools along with the teaching learning condition should also be incorporated as independent variable in future research. Longitudinal studies also be planned in order to know the exact nature of development of these processes.*

*There are certain extrinsic factors, that could covary with the reading achievers, should also be given due attention. We felt the extrinsic factors might be socio-economic-status, Sex, Caste, home environment, Urban-rural background etc. These factors have high influence on the reading achievement of the students. Future research should focus on reading status both along with and without these covarying factors. This would minimize the questionability of research findings arising from the selection of sample with unequal socio-demographic characteristic.*

*The reflection-impulsivity information processing has revealed important implications for problem solving situations and academic achievements independently of I.Q., very little is known about the exact dynamics or theoretical basis which operates to differentiate reflective and impulsive information processing. The present study has highlighted the practical significance and clear implication of the MFFT task and reflection-impulsivity dimension in young children of primary grades, but the dynamics of R-I or explanatory basis of R-I has not been addressed in the study. Although different interpretations such as constitutional factors, criterion for accuracy, inability to inhabit responses, anxiety over errors, anxiety over competence, faulty metacognition, motivation, differences in attentional deployment, and*

*differences in performance of information processing, effort processing etc. exist in the literature here and there. The issue has been complicated by the possibility that the above factors might be very well inter related and overlapped with one another and that reflective and impulsive information processing may be in the service of different forces. The explanatory model based on the integration of motivational and effortful processing proposed in the relevant literature has not been made in the literature in this direction. More controlled and well defined studies be conducted in future in this direction.*

*Although , the cross-cultural generalizability about the relationship between speed and accuracy of MFFT has been established, the dynamics underlying differential rate of increased or decreased of speed and accuracy in different cultures need to be investigated. For example, while American, Canadian, Indian children show comparable developmental patters in MFFT, the Japanese children show unique developmental trend in speed and accuracy in MFFT, which is different from children of other culture. As the Japanese children grow older, the error rate reduced dramatically showing increasing competence and reflective cognition without substantial increase in latency rate. The latency-error co-relation in Japanese children is low compare to the co-relation found in other cultures. Hence the dynamics of developmental trend in speed accuracy trade-off while the children make in problem-solving tasks in different cultures need to be addressed in future research.*

*The present study has utilized the cross-sectional designs in order to find out the developmental trend in MFFT and in other information processing tasks. Cross-sectional designs as such have inherent problem as pointed out by many authors (Baltes et al. 1977). For example, age differences are confounded with Cohort (year of birth) effects. Since intra-invidiual change is not directly studied but rather intended to be approximated by age-group differences, it does not even approach accuracy unless cohort effects are negligible. In fact, most of the currently available data in developmental psychology are cross-sectional and hence likely to be afflicted by*

*cohort effects. In future longitudinal and the combination of longitudinal and cross-sectional designs, i.e. sequential designs must be employed to verify and strengthen the findings obtained in the present study. Sequential designs are suitable to study intra-individual changes in a changing world and can separate age changes from cohort effects.*

*The study highlighted the importance of motivational-effort deficiency explanatory model in case of impulsive information processing and low reading achievers. However, the operationalization and assessment of the concept of motivation as well as effort have intrigued the research for long time and have thrown real challenge to the future generation of psychologists. Assessment of motivation as well as effort independent of task difficulty can not be visualized until recently. As a result, inferior performance in difficult cognitive task has always been attributed to the deficiency in skill domain. The independent status and unique role of motivational effort dimension has always been confounded with the conceptualization of basic reasoning skills. In future, one of the major tasks of the researchers would be to design suitable tasks and develop standardized suitable tests in order to tap the motivation-effort dimensions independent of task difficulty. Also more research efforts be directed for precised definition of the above concept in clearer terms with out much ambiguity. Perhaps, the teacher ratings parents rating and peer ratings of motivational effort can supplement the objective test of motivation and effort evaluation.*

*Despite of common feelings, children having reading disability do not fall in to set / categories. They are found in all age groups, all ranges of intelligence, all cultural groups, and all types of physical and personality make ups. Pupils who read poorly grow up in diverse environments, they may leave with understanding or punitive parents in happy or broken homes. Some may be seriously affected by these conditions and others remain untouched. Therefore, in future, research should concentrate more on therapeutic procedure to be based on individual problems of the dyslexic rather than on common causes and preferably in the regular school setting.*

# CHAPTER - V
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